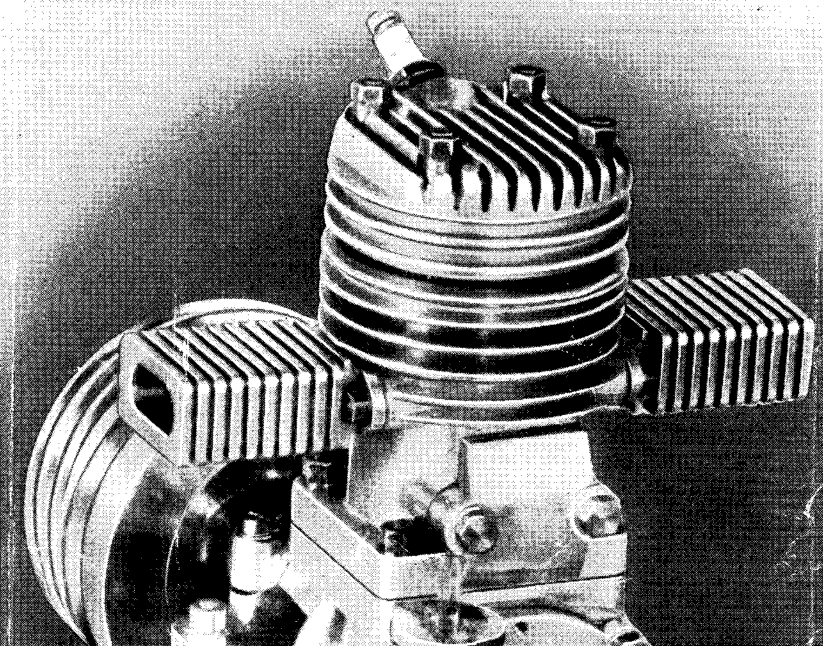
THE MODEL ENGINEER



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The MODEL ENGINEER

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10TH JUNE 1943 VOL. 98 NO. 2455

SMOKE RINGS

Our Cover Picture

● THE ENSIGN 10-c.c. engine which was described in our companion journal, *The Model Car News*, has already proved highly popular among constructors of small petrol engines, and several of these engines have already been completed. The example shown was produced by Mr. F. Boler, Secretary of the Leatherhead Model Engineering Society, who is also a very active member of the Pioneer Model Car Club. It is an excellent example of good workmanship and finish, and embodies many individual details and improvements, including the finned exhaust pipes. Mr. Boler informed me that the engine was an instant success and shows great promise of high performance. It is intended for use in a car built to the M.C.N. Special design.—E.T.W.

The "M.E." Exhibition, August 18th-28th

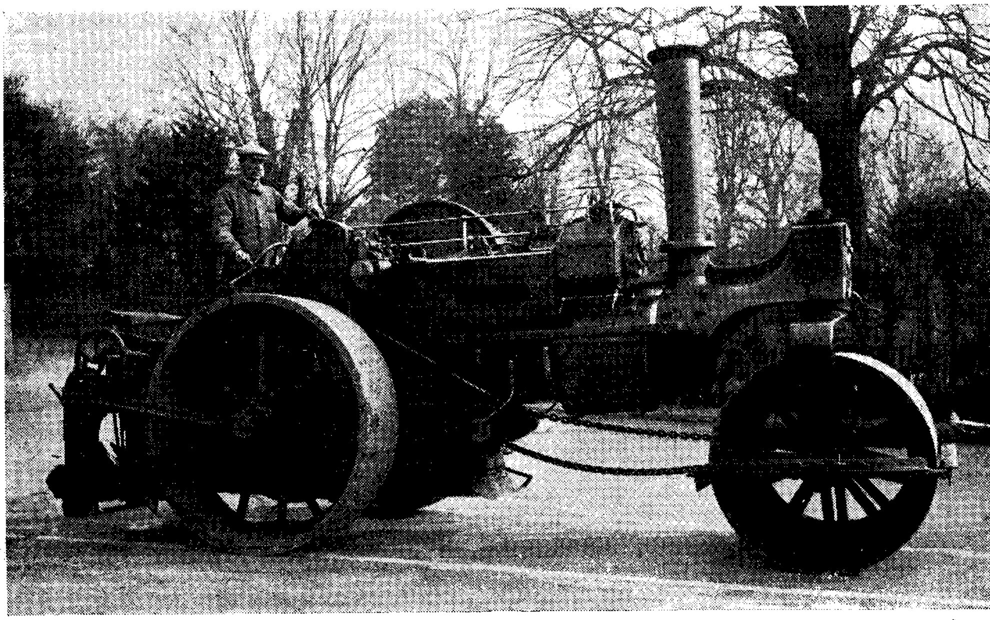
● THIS YEAR THE MODEL ENGINEER Exhibition has been planned to introduce a number of new features, whilst retaining those which in past exhibitions have proved their popularity. In addition to the circular track, introduced for the first time last year, where model race cars, speed boats and aircraft will be operated, the multi-gauge passenger-carrying railway track run by the S.M.E.E. will be re-introduced. One of the new features of the Exhibition—which from the interest point of view alone will be considered by many to justify their visit—is the display of international models which will form a section with the loan exhibits. The prices of admission will be the same as last year, namely, 2s. 3d. for adults and 1s. for juniors under 14, the inclusive dates being the 18th to the 28th August and the hours from 11 a.m. to 9 p.m.—P.D.

Exhibition Entry Forms and Prizes

● OUR EXHIBITION MANAGER tells me he has sent out entry forms for the Competition Section of our forthcoming exhibition to all listed club secretaries and also to last year's competitors. If you wish to enter a model in the Competition Section of our exhibition and have not yet had the necessary form, please send a postcard to The Exhibition Manager, 23, Great Queen Street, London, W.C.2, who will be pleased to send you a form post free. As the closing date for the receipt of entries is July 12th, readers are advised to send off their entries without delay. Last year many entries were received too late for inclusion. On page 621 of this issue we give details of the various sections into which the competition is divided and a list of the prizes and awards.—P.D.

Model Locomotive Competition Result

● IN "SMOKE RINGS" for December 4th last, there was an announcement of a competition organised by the Leeds Model Co. Ltd., to encourage the actual construction of small-scale locomotives as a contrast to the mere assembly of finished parts. I have now received a list of the prize-winners, who are: *Senior Section*, Mr. J. R. Hayward of Amersham; Mr. I. L. Joice of Acomb and Mr. R. Dunning of Higher



Poynton. *Junior Section*, Mr. D. Walch of Bristol, and Mr. J. D. Bennion of Nailsworth. A special Merit Prize has been awarded to C. Scott (age 14) of Belfast.—J.N.M.

"Old Faithful"

● I HAVE lately received from Mr. G. E. Giles, of Faversham, Kent, a letter of the kind which always delights me. Mr. Giles is obviously no longer young, but he is equally obviously an enthusiast. But I will quote his letter:—"I have been a reader of THE MODEL ENGINEER for many years, and wondered if other readers would be interested in this small contribution from me. I have had a long experience of driving various types and makes of road locomotives, having started my career in 1906 and driving since 1911. For the past twenty-four years, I have driven and kept in repair the roller seen in the photograph reproduced here. It is an Aveling & Porter 12½-ton compound, and it left the works in 1906. It is still in excellent conditioning, even to retaining its original firebox. The Morrison Scarifier was originally on a much older roller from which it was taken and put on to this one several years ago. The number on the scarifier is 179. For the greater part of my service with the roller, it has worked in the Rural Area and is known by the name of 'Old Faithful.' I am a member of the newly-formed society of model engineering in Faversham and hope to build a model of this roller." Steam rollers have not very often figured in the pages of THE MODEL ENGINEER; but I am especially pleased to give a little space to "Old Faithful," on account of the affection her master has for her. But I am sure many readers will share my good wishes to Mr. Giles for success in the building of his model of her.—J.N.M.

The Fascination of Steam

● MUCH HAS been written upon the fascination that steam engines have for those who work with them. Surprisingly, however, it seems that the influence extends also to those whose occupation is with the more modern internal combustion engine. As an example of this phenomenon, I quote from a very pleasant letter received from Mr. George Jarrett, an agricultural contractor down Somerset way who writes:—"My own contracting work is done by Case and Fordson tractors, as being one of the younger generation I have not had the pleasure of working the steam tackle. However, my heart is in steam, and I am hoping shortly to buy a steam traction engine of my own. It will be bought largely for sentiment, and also with the hope of making use of it on some of the jobs in my daily work. Having advertised, I have been inundated with offers, and have something like seventy or eighty engines all over the country to pick from. They range from Burrell 8 h.p., Fowler 'Big Lion' showman's locomotive to the smaller types used for threshing. Prices range from £22 10s. 0d.—at which price I am offered the pick of three—to £400." In these days of oil shortage, a steam engine at £22 10s. 0d. sounds like a commercial proposition for anybody with access to supplies of solid fuel.—P.D.

A Radio-Controlled Launch

by R. M. Cooper

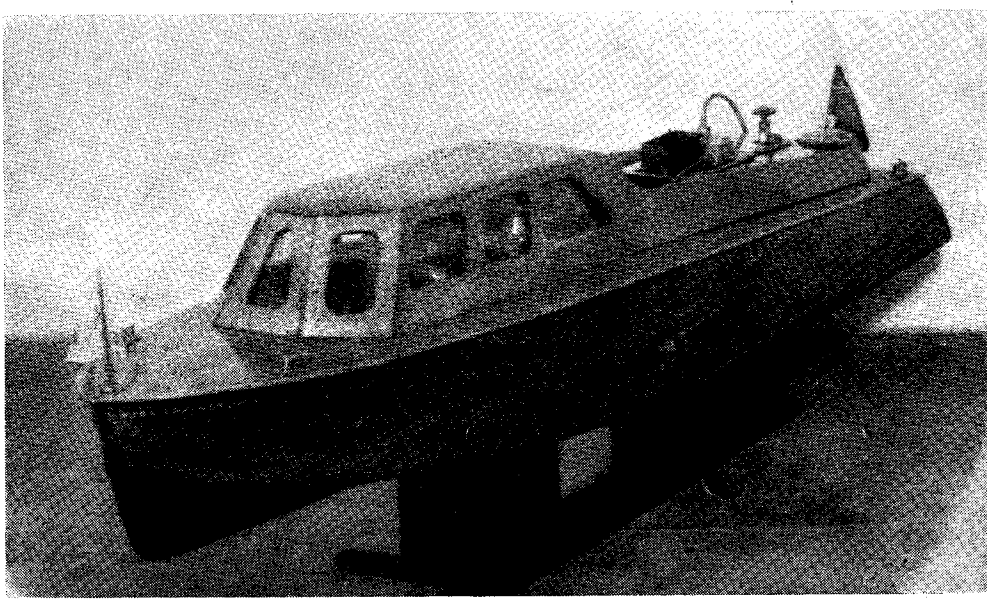
A GREAT deal of experimental work in the remote control by radio of small power boats has been carried out in this country and the U.S.A. Difficulties have arisen, due to the limitations imposed by the size and weight of additional equipment required to be carried. Much has been said in the past about extremely small radio components, valves, and also battery power supplies, but the recent war with its demands for efficient but small apparatus has resulted in the development of apparatus which enables designers to regard this field of development as having progressed to the stage where remote control now becomes a practical proposition.

The author has constructed apparatus which seems to solve a number of the many problems. In the past it was necessary to construct large boats to carry all the equipment, but by the methods which are to be described and which, I believe, have not previously been applied to models, construction on much smaller lines is now possible.

Orthodox methods of control have been discarded in favour of a system to incorporate " Servo-mechanisms " to reduce the weight of power supply equipment. These methods are particularly suited to a wide range of control, but as the component parts need some skill in construction, the minimum number of control operations required for manipulation of the boat whilst afloat has been carefully considered so as to limit the number of these relatively unusual electro-mechanical devices.

A model M.T.B.-type fast launch of the Metre Class has been constructed for the installation of the apparatus to be described and she has been named *Miss Lexington I.* A feature of this craft is that it is designed to operate under radio control at a radius of two miles, and it embodies the following features :

1. Rudder control, giving automatic and continuous port and starboard turns under response from the transmitter.
2. Control of the engine drive, two speeds being provided, i.e. tick-over for shore manoeuvres and full speed.
3. Lighting of cabins whilst at sea.



A view of " Miss Lexington I " on stand, ready for a test run

Although tests are not as yet complete, it is hoped to obtain a speed of 20 m.p.h. on straight course with this motor, and the hull has been ribbed and double-skin planked for lightness and strength. The stern tube has been set as near horizontal as possible, with a Stuart-Turner B.B. engine set well forward to allow good hydro-planing.

Fig. 1 shows in diagrammatic form the chain of sequences in the control system, the operation of which is as follows : a 5-valve super-heterodyne receives unmodulated radio frequency impulses from the transmitter at a frequency of 28 megocycles. These impulses are fed to the output stage of the receiver where they operate a relay which, for each impulse, turns a selector

steam switch one position. This switch is a double-pole six-position Yaxley type, and is operated through a pawl and ratchet system. The advance switch positions are each connected with their separate control mechanisms through a common slug relay, which delays operation of each individual circuit for about one second.

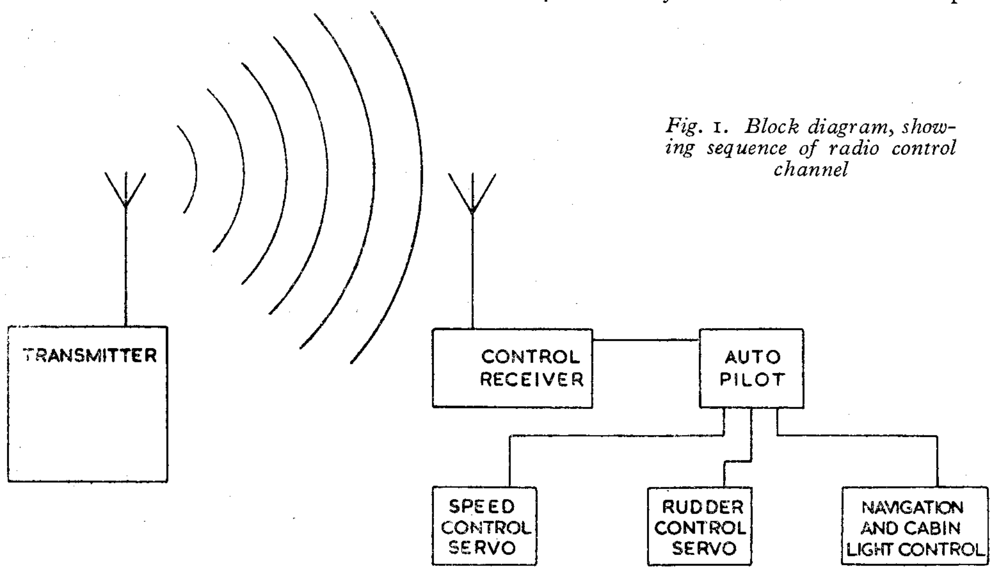


Fig. 1. Block diagram, showing sequence of radio control channel

Such delay allows the traversing of the whole of the circuits without any of them responding until the operator delays for one second at the required position, causing the "servo-mechanism" required to come into operation immediately. This selector then is the so-called brain of the boat, or in effect the auto-pilot, and has been arranged in *Miss Lexington I* in the following sequences :

Position 1.—Slow speed—straight course.
,, 2.—Full speed—straight course.
,, 3.—Starboard turn.
,, 4.—Full speed—cabin lights—straight course.
,, 5.—Port turn.
,, 6.—Full speed—straight course.

The sequence of events to control the craft are as follows :

1. Start the engine and switch on the receiver and transmitter, checking both before starting the run ; also ascertain that the auto-pilot is in position 1.

2. The engine is set to tick over for slow speed and the boat sets out on her course.

3. One impulse from the transmitter sends the boat to full speed, straight course, and she should now be given plenty of space to operate by sending her well out before manoeuvres.

4. A run may now be carried out. An impulse turns the boat to starboard, and so long as the transmitter key is depressed, the turn will continue and a number of complete circles executed, but immediately pressure on the key is lifted, she will immediately go into a straight course.

5. The next impulse also gives straight course, but includes cabin lights. This is for effect, but also serves as a marker position between the operator and the boat to prevent confusion of selector position on the auto-pilot. Position 5 gives the same operation for port side as in the case of starboard, whilst position 6 gives full speed, straight course.

6. On the completion of the run, the boat is guided in to the operator and when near to shore is switched to tick over or slow speed so that she is easily caught in shore.

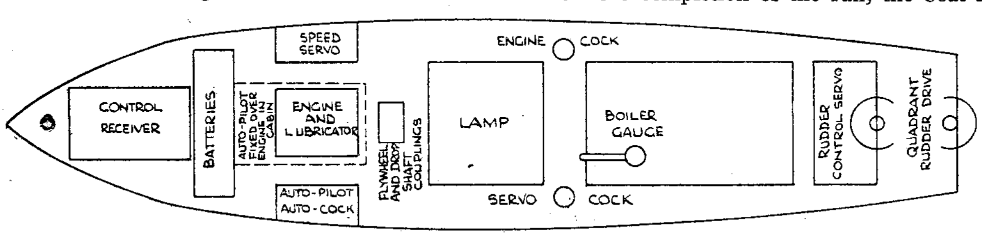


Fig. 2. Block diagram of disposition of equipment in boat

It can here be stated that the receiver system is tunable and quite selective, so that races could quite easily be organised. The layout of the relay mechanisms and radio apparatus is shown in Fig. 2.

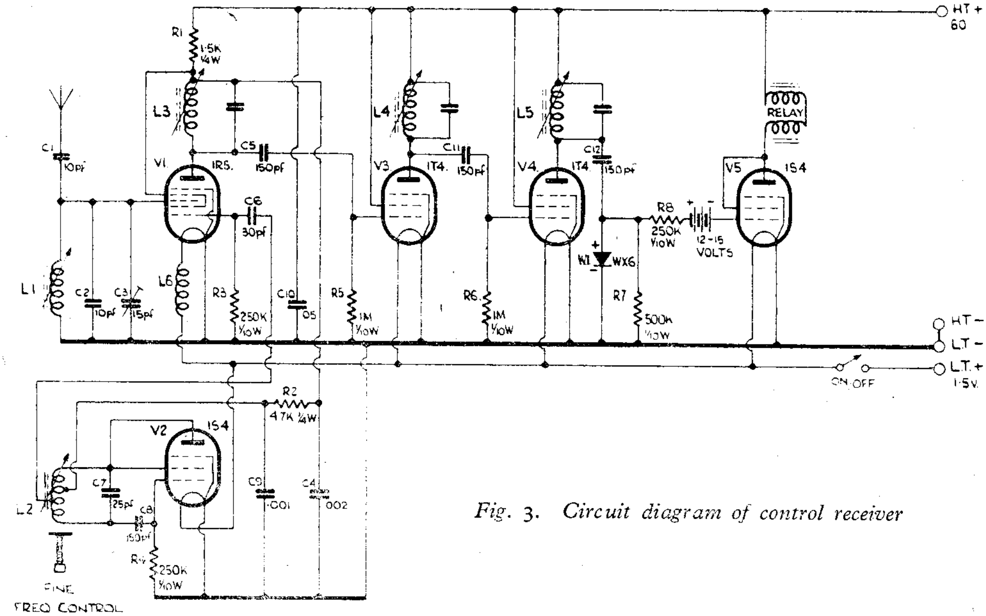


Fig. 3. Circuit diagram of control receiver

Control Receiver

The design of a receiver suitable for efficient operation, and yet light and compact, presents a complex problem as, in addition to the above features, it must be selective and highly sensitive to operate up to two miles from a small portable battery transmitter, with an inefficient antenna, and earthed in each case. In addition, it is necessary to operate in the short waveband 28 megocycles, the band permitted by the G.P.O., with its attendant difficulties, i.e. drift due to vibration and temperature differences in the boat and instability due to limitation in effective screening and the proximity of components, whilst at the same time power supplies must be extremely small.

Orthodox radio equipment was discarded in favour of the new miniature valves and components now available, enabling a superhet circuit to be employed to ensure maximum sensitivity and selectivity being obtained.

A circuit of the receiver is shown in Fig. 3, the valve line-up being a 1RS Pentagrid frequency changer, with a 1S4 Pentode, coupled as a Hartley oscillator. These are followed by two 1T4's as I.F. amplifiers, followed by a WX6 Westinghouse westector as second detector. The output from this stage is fed into a power amplifier network, utilising a 1S4 Power Pentode, which feeds the relay.

Bias voltage on the 1S4 output pentode is regulated so that a steady anode current of 0.5 milliamps is obtained, and the relay adjusted so that it operates at about 1.2 milliamps.

At first the receiver was designed with one I.F. stage, and a diode valve was used for a second detector, but experimental tests proved that this, together with the band-pass I.F. network then incorporated, made the receiver too selective, and the amplitude of the signal then fed to the diode was insufficient for its efficient operation.

The change was then made to the present network, and as will be seen, two stages of I.F., using single-tuned circuits R.C. coupled, were arranged.

This gave a somewhat broader response curve, and much greater gain per stage, so that a signal sufficient to operate the second detector efficiently was obtained, the whole resulting in much greater overall sensitivity.

The frequency changer was first made to operate also as oscillator, by utilising cathode injection, but this proved too unstable, and subsequently a separate oscillator was incorporated.

A photograph of the receiver is shown in Fig. 4. Next to it are the batteries needed for its operation.

The latter consists of a 1.5 volt flashlight cell, needed for the heaters of the valves, which each draw 0.05 amp. at 1.5 volts, whilst the 60 volts H.T. is obtained from two 30 volt miniature cells, as used in the V.T. fuse. The 12 volts bias battery can be made up from a section from out of these latter, it being easily separated by means of a knife, each small cell counting as 1.5 volts.

I.F. coils—which are tuned to 1.6 megacycles, the oscillator and aerial coils are of the miniature iron-cored variety, as seen in the photograph; and have a good Q so as to ensure high sensitivity.

By the aforementioned principles, and the use of a five-valve superhet, it is possible to operate over a distance of two miles; but where a smaller and lighter receiver is necessary, and a lesser operating distance (say half a mile) can

be tolerated, a much smaller receiver is easily designed, which would also be much lighter, particularly if a simple T.R.F. or a straight circuit were adopted, and in addition it would probably function on smaller H.T. voltage.

A receiver, such as the latter, would be most suitable for the control of model aircraft, and of course also for boats of a smaller class than one metre.

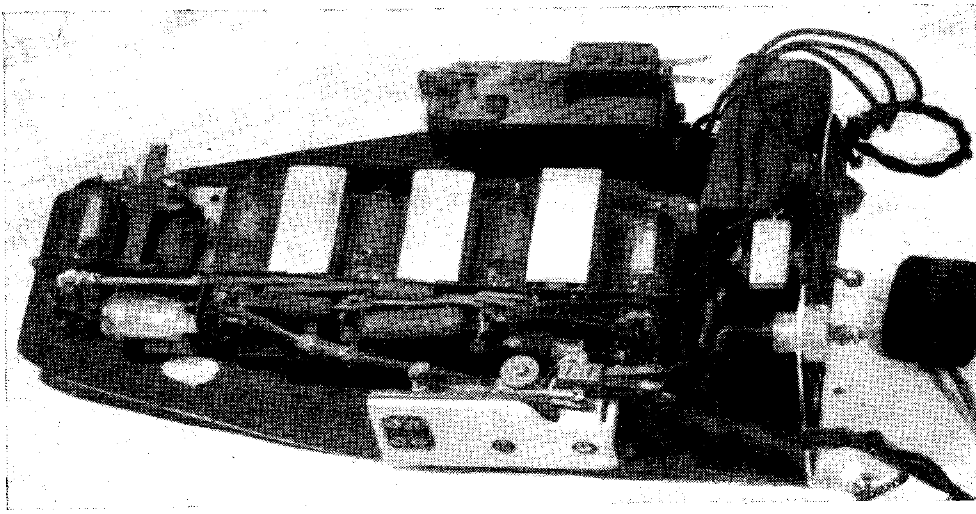


Fig. 4. Photograph of complete receiver with cover removed, showing relay, delay relay, and batteries

Receiver Alignment

A signal generator and output meter are essential for proper alignment of the receiver, and the procedure is as follows :—

Disconnect the H.T. from one side of the relay and insert a milliameter. Adjust the pentode anode current to 0.5 milliamps approximately.

Connect a signal generator—tuned to 1.6 megacycles—to the last I.F. valve, and tune the last I.F. coil to maximum current, as shown on the meter. *Note.*—The current should never be allowed to increase beyond 5 or 6 milliamps, and the signal generator output should be reduced accordingly.

Next apply the signal generator to the next I.F. grid and repeat, and finally connect the generator to the frequency changer grid after first stopping the oscillator by shorting the grid coil to chassis. The last I.F. coil can now be aligned.

Set the generator to 28 megacycles, connect it to the aerial, remove the short from the oscillator so that it is allowed to operate, and tune the oscillator coil to resonance, followed by a similar procedure with the aerial coil.

The set is now aligned and ready for tests, which should be made with the transmitter.

Transmitter

Experimental tests during research on the transmitter soon proved that the midget valves were limited in this direction, due mainly to power output, and although at first glance it may be thought that care with the transmitter is not so important, the author nevertheless gave it the same care and consideration as the receiver.

It is, of course, imperative that the following features are stringently investigated :—

1. Frequency stability and freedom from drift.
2. Maximum power output in the antenna for battery valves used, assuming an inefficient antenna and probably no earth.
3. Minimum number of valves and power supplies.
4. Portability and robustness, together with ability to carry without impediment to use of hands.
5. Simplicity and ease of adjustment.
6. Necessity of stability of the power amplifier under all drive conditions, and generally total electrical reliability to prevent accidental loss of the boat.

(*To be continued*)

Hornblock Castings for Small Locos

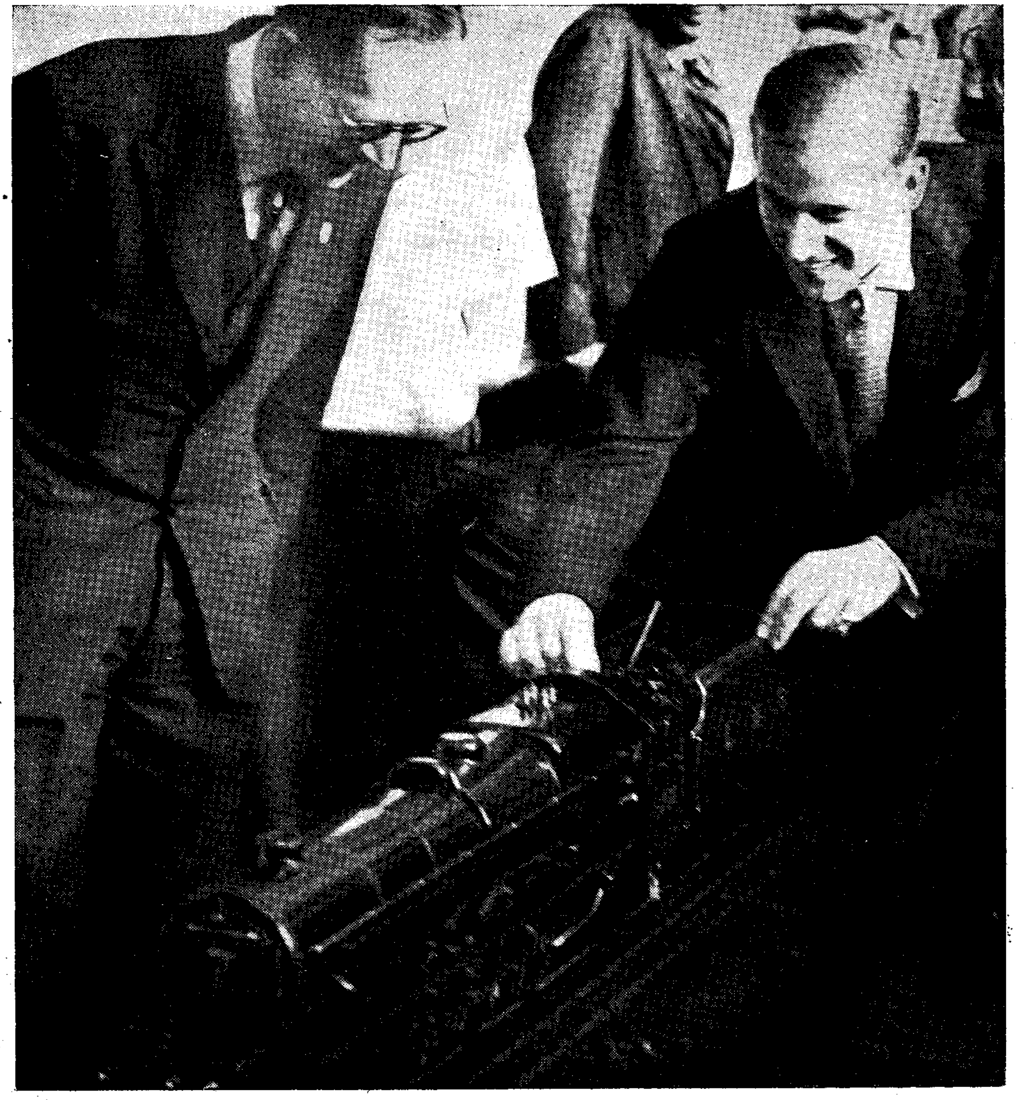
We have received from W. H. Haselgrove, 1, Queensway, Petts Wood, Orpington, Kent, a sample set of cast gunmetal hornblocks for "L.B.S.C.'s" 5-in. gauge 4-4-0 "Maid." The castings are nice and clean, free from unnecessary metal and would require very little machining to make them ready for assembling in the frames. In fact, about 15 minutes' work with a file on each seems to be all the machining, apart from drilling the holes for the rivets, that is wanted.

H.R.H. The Duke of Edinburgh

Displays a Keen Interest in Model Engineering

ON Thursday, May 20th, His Royal Highness the Duke of Edinburgh visited the S.M.E.E. Affiliation Jubilee Exhibition, where he was received by Sir Harry Lindsay, Director of the Imperial Institute, and the president, chairman and secretary of the S.M.E.E. Affiliation.

His Royal Highness spent some three-quarters of an hour going round the exhibition, and showed great interest in the "OO" gauge layout of the North London Society. He also spent a considerable time inspecting and discussing with the builder, Commander Barker's four historical marine engine models. After inspecting the S.M.E.E. test benches and seeing a model turbine worked up to speed, the Duke went to the track, where he was introduced to the locomotive *Princess Elizabeth* and its builder, Mr. E. J. Linden. His Royal Highness drove the locomotive, with full load, up and down the track. Following this, he spent some time inspecting the various models, showing particular interest in the model paddle engine made by Mr. A. W. Marchant, which has been accepted by the Science Museum. H.R.H. was greatly intrigued by the display of model trams as shown by the Tramway & Light Railway Society.



Link Motion for "Minx"

by "L.B.S.C."

WHEN getting out the preliminary drawings of the "Maid of Kent" and the "Minx," I tried to make the principal components as much alike as was possible, to simplify the job, and cut cost and labour; and an examination of the reproduced drawing of the link motion type of valve-gear for the "Minx," will reveal its similarity to that of the "Maid." In fact, the only difference in the actual gear is the slight alteration in dimensions to suit the different wheelbase and the higher position of the cylinders; therefore we won't have to go into a lot of detailed instruction again, as the notes already given for the "Maid's" link motion is equally applicable in the present instance. All I need do, is to point out the differences where they exist.

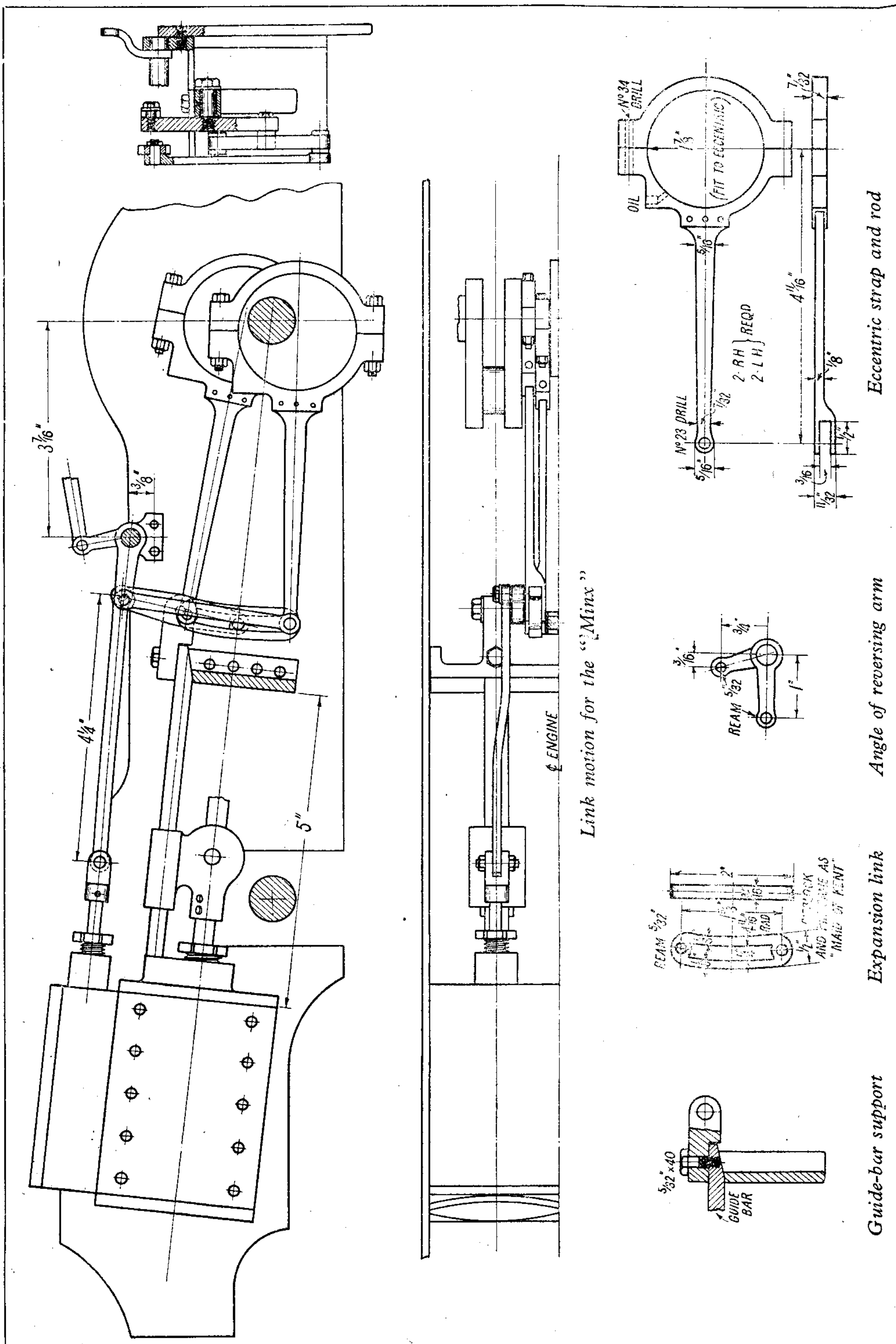
As the "Minx" has single overhead guide-bars and box-type crossheads, a different motion-plate will be necessary. There are no lugs on the front of the casting; but the lugs on the back, which carry the valve-gear rockers, are made a little wider, and are recessed on the underside to accommodate the end of the guide-bar as shown in the small detail illustration. If I were doing the job myself, I should grip the motion-plate upside down in the machine vice on the table of my vertical miller, and form the main part of the seating with a long-stemmed $\frac{3}{8}$-in. end-mill or slot-drill held in the chuck or collet, finishing off the little bit that the end-mill wouldn't reach, with a file. This process can be duplicated in the lathe, by using the end-mill or slot-drill in the three-jaw, and fixing the casting either to top-slide or saddle, at correct height, side flanges upwards, and the lugs farthest away from the chuck. If a planer or shaper should be available, a cranked tool in the clapper-box would make short work of the whole lot. If you cannot machine the job, and have difficulty in filing or chipping out the recess, use separate lugs. These are easily made up from a piece of $\frac{1}{2}$-in. brass bar $1\frac{3}{8}$ in. long, one end rounded off and drilled and reamed for the rocker fulcrum-pin, and recessed or rebated on the underside $\frac{3}{16}$ in. deep and $\frac{5}{8}$ in. long. The motion-plate may either be a casting with the original lugs sawn off, or a piece of $\frac{3}{16}$-in. steel plate measuring $4\frac{1}{8}$ in. long by $2\frac{3}{16}$ in. wide, with the slots for the connecting-rods cut in it, and a piece of $\frac{1}{8}$-in. by $\frac{5}{16}$-in. angle riveted to each side for attachment to frames. A nick could be filed or milled in the top of the plate, above the connecting-rod slots, the lugs jammed in, and brazed or silver-soldered. A piece of $\frac{1}{4}$-in. rod should be placed through the two fulcrum-pin holes whilst brazing or silver-soldering, to ensure them lining up properly.

Alternatively, the connecting-rod slots could be cut as shown; the lugs shortened by an amount equal to the thickness of the plate, butted end-on against same in the correct position above the slots, attached by a screw through the plate, and then brazed or silver-soldered in position. The end flanges of a cast plate are machined as described for the "Maid" and the two holes drilled in the top of the lugs, as shown in the plan view, for the guide-bar screws. The whole doings is then erected in the frames, at right-angles to the line of motion, the front of the plate being exactly 5 in. from the back of the cylinder casting (see elevation view). Locate, drill and tap the screwholes, as given in the "Maid" instructions. Hexagon-head screws, or round-heads, may be used as desired. For attaching the guide-bars to the lugs, you'll have to make a couple of screws as shown, from $\frac{1}{4}$-in. hexagon steel, as 5/32-in. by 40 screws are not made commercially, and the ordinary threads are too coarse for use in this particular position. Tip: before drilling and tapping the side holes in the motion-plate, attach guide-bars to lugs, and put the crossheads as near to the motion-plate as they will go. This will automatically locate the plate in correct position for easy working.

Variations in Dimensions

The actual parts of the valve-gear are made up as described for the "Maid," except for the following differences in dimensions. The length between the centres of the eccentric-straps and the eyes in the fork, is $4\frac{11}{16}$ in. in place of the "Maid's" $4\frac{1}{4}$ in. The radius of the expansion-link is also $4\frac{11}{16}$ in. to match. Both the rocking levers are exactly the same as the "Maid's"; but the plain part of the fulcrum-pin is $\frac{1}{2}$ in. long, as the lugs are $\frac{7}{16}$ in. wide, and we have to allow another $\frac{1}{16}$ in. for a rubbing washer. This pin will just go in, its approximate overall length being $\frac{13}{16}$ in., and there is a little more than that between the side of the lug and the main frame.

The valve-spindle forks are same as the "Maid's"; the valve-rods which connect the forks to the tops of the rockers, are $\frac{1}{16}$ in. longer, to wit $4\frac{1}{4}$ in. between centres of eyes, but the rods are offset $\frac{3}{16}$ in. as before. The lifting links are exactly the same as those specified for the "Maid," and the only difference in the weighbar shaft, is that the reverse-arm is set $\frac{3}{16}$ in. off the right-angle position, instead of $\frac{1}{8}$ in. The eccentric-rods, expansion-links, die-blocks, rockers, and lifting-links are all assembled in the same way as detailed out for the "Maid." The centre-line of the weighbar-shaft should be $3\frac{7}{16}$ in. ahead of the vertical centre-line of the driving-axle, and level with the top line of the frame; see elevation of gear. The holes in the frame for the screws holding the brackets or bearings, which are the same as the "Maid's," are drilled No. 30; the first at $3\frac{1}{4}$ in. ahead of centre of driving-axle, and $\frac{3}{8}$ in. from top of frame, and the other hole $\frac{5}{8}$ in. ahead of it. The weighbar-shaft is erected and connected up exactly the same as the one on the "Maid." When the gear is properly made and erected, it should work easily, and you should be able to reverse it without anything binding or trying to jam, in any position



Link motion for the "Minx"

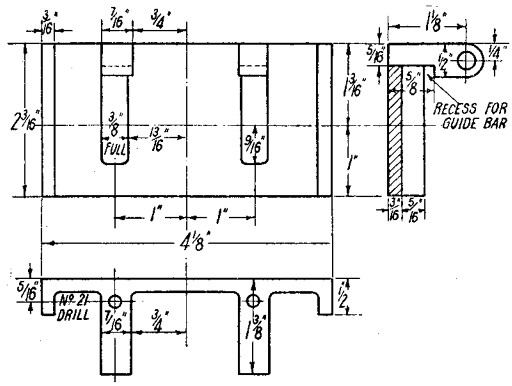
Eccentric strap and rod

Angle of reversing arm

Expansion link

Guide-bar support

of the cranks. As the boiler feed-pump for a link-motion engine will have to be located below the guide-bars, and driven by an offset eccentric-rod, all being well, I will describe that before going on to the alternative Joy valve-gear, which is also the same for both engines.



Motion plate

Jumping to Conclusions

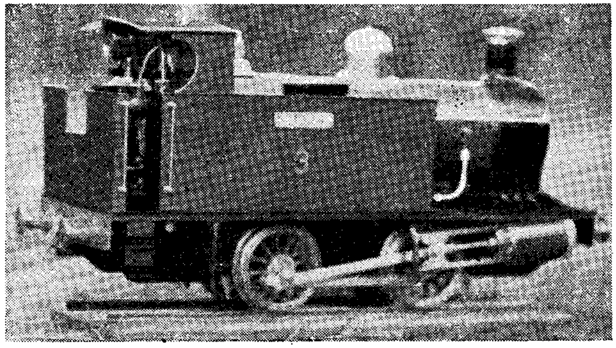
Occasionally, an error in dimensioning will creep into my drawings, which is hardly to be wondered at, when running four locomotive "serial stories" at once, and making drawings for same as I go along. For example, there was one in the general arrangement of the gauge "1" "Juliet"; the opening for the cylinder in the frame was dimensioned 1 in. when it should have been shown as $1\frac{1}{8}$ in., the length of the steam-chest. This was naturally so obvious, that out of all the engines built (a goodly number indeed, judging from the amount of castings and material sold by our advertisers) only three builders troubled to query it, the rest merely cutting the frame $1\frac{1}{8}$ in. to suit the steam-chest, and they then found that all was well. Two of the before-mentioned querists merely called my attention to the error in a friendly way, for which I thanked them. No. 3, however, got himself into a bit of a tangle over it, and did a lot of unnecessary work. Now I am certainly not going to hold him up to ridicule—far be from me any such intention; anybody is liable to commit an error, same as I did with the figuring. But the case is such a good illustration of the folly of jumping to conclusions, that I feel it would be worth quoting, to save others from falling into similar traps, and giving themselves "hard labour without the option."

Our friend noted the error in dimensioning, but he also noticed something else, viz., that the upper cylinder flange projected above the line of the running-board, which passed across one of the screwholes. He immediately jumped to the conclusion that I had placed the cylinders too high, so he made a new pair of frames, with the holes for the steam-chests lower down, bringing the flanges below the running-board. Then he found that the connecting-rods wouldn't fit, and other complications had set in, and finally sent in a letter of complaint "to prevent other unfortunates being led astray." Well, the only "unfortunate" who was led astray was our worthy friend himself. The cylinders, as originally shown, were perfectly all right, and in the correct position; all that was necessary, was to file a small clearance in the running-board, to allow it to fit around the cylinder flange, same as you file a clearance for the upper parts of driving wheels on an engine with big wheels. This was how I intended the running-boards to be fitted; and had our friend sent me a courteous note querying the cylinder position before making new frames, I would gladly have put him wise, and saved him trouble.

A Completed "Juliet"

by H. Brookman

THE reproduced photograph is of a $3\frac{1}{2}$ in. gauge "Juliet," which has taken me seven months of spare time to build. It is to "L.B.S.C's" words and music, with the exception of the lubricator which is the "Auswal" type. The locomotive has been tested under air and seems to be all right, and as soon as the "Basic" returns, the Malden track at Thames Ditton will see her next test. This locomotive, by the way, has been a rest job from a $3\frac{1}{2}$-in. "Uranus" which is about one-third finished to date. The photograph was taken by A. D. Cooke.



A $3\frac{1}{2}$-in. Gauge "Pacific"

by "113"

THE building of this locomotive was the result of an outline drawing published in THE MODEL ENGINEER for January 24th, 1946.

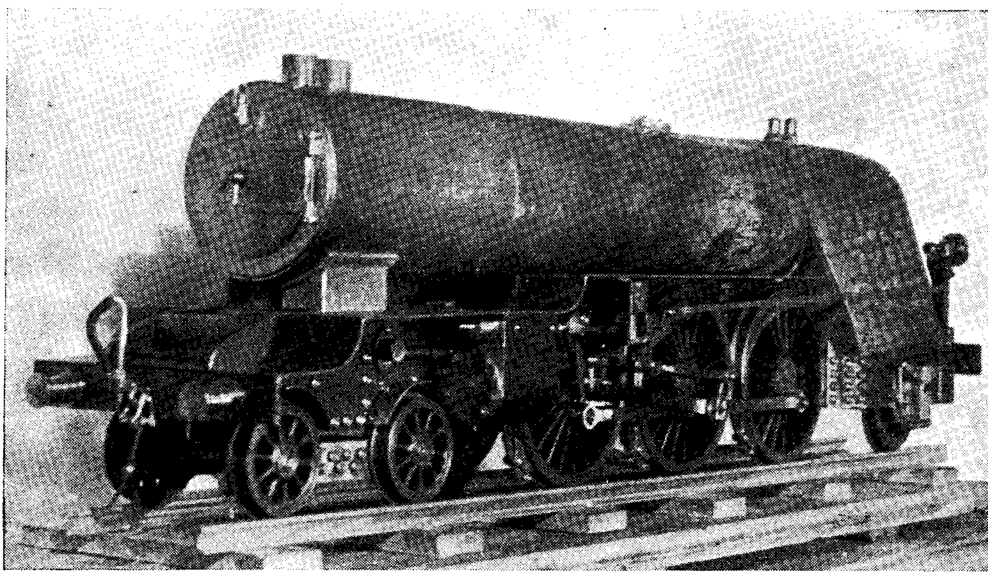
Having obtained the castings and material for main frames, etc., a start was made on the main frames on the Saturday afternoon of Easter week-end, 1946. The frames were cut out and erected by Sunday tea-time, all the drilling being done on a Drummond 4-in. round-bed lathe which was kindly loaned to me by a model engineer friend, and on which, incidentally, all the machining to date has been carried out. Readers must forgive some of my methods of doing certain jobs, but as the lathe is the only machine-tool that I have, apart from a small drill, difficulties naturally cropped up, but were got over by the usual wangles and fiddles which are associated with the model engineers' workshop.

The frames were held in a small vice and cut out with an "Abrafile," an angle-plate of the Drummond serving as an extension of the rear jaws of the vice to take the extra width of material. The trailing wheel frame was fabricated from $\frac{1}{8}$-in. black mild steel, the procedure being the same as for the main frames.

The radial axle-boxes on the trailing axle were milled out for me by a friend on a milling machine in the firm where I work; they have a 14-degree angle on each side, and the horns and slots in the frames were filed to suit.

The bogie stretcher was tackled next in the four-jaw chuck, the pin being turned, which resulted in the job nearly going through the workshop window by flying out of the chuck, so another method had to be resorted to.

The bogie was the next item to come in for machining, the rubbing-plate being machined by turning on the faces in the four-jaw, and edges by a 3-in. by $\frac{3}{8}$-in. side and face milling-cutter on a stub mandrel held in the headstock, while the job was clamped on the cross-slide. The bogie wheels were turned up with a "Wimet" tipped tool, which I obtained through the tool club in my firm at the small cost of 10s. This tool has done all the heavy machining of phosphor-bronze, steel and cast iron, to date, with no sharpening whatsoever. The bogie was finally finished by the following Sunday.

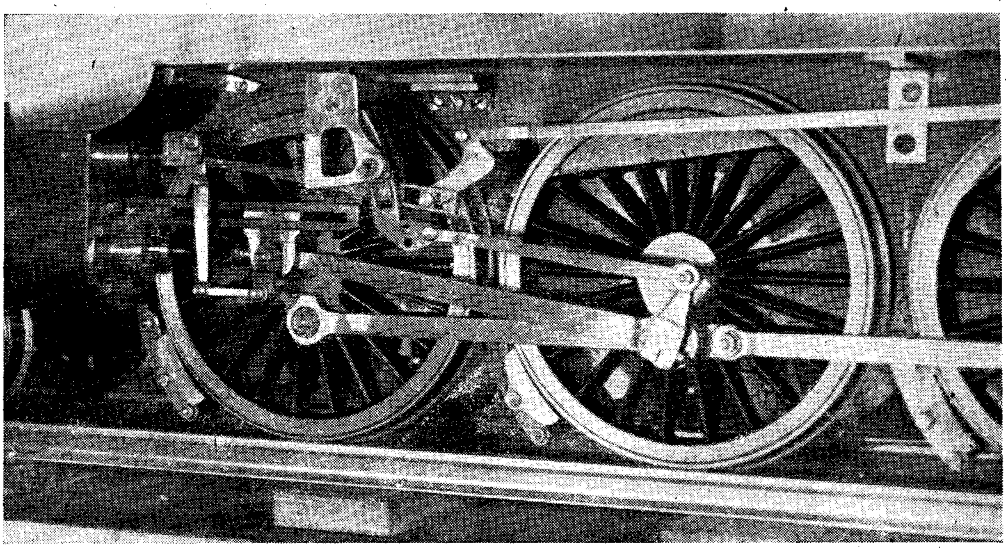


A three-quarter front view of the $3\frac{1}{2}$-in. gauge G.N. "Pacific" locomotive

The driving wheels were next on the list. These being 5 in. diameter caused me to think a bit until I hit on the idea of making a sub-plate to bolt to the faceplate, with a pear-shaped hole in the centre to take wheel and crankpin boss.

After I had made this up, a start was made on the wheels. These were found to be so hard that a lathe tool would not get under the skin, so they were taken to the firm and were put in the annealing furnace for 12 or 14 hours. I was able to make another start on the following Saturday, this time with complete success.

The next problem was how to machine treads and fronts of wheels this size with no chuck available to hold them; so a No. 1 Morse taper drill-chuck shank was procured, the chuck end turned parallel and a sleeve driven on. This stub was put into the headstock of the Drummond, the faceplate fitted to the nose and the wheel placed on the mandrel and bolted through spokes to the faceplate. This arrangement worked very well.



A close-up of the valve-gear

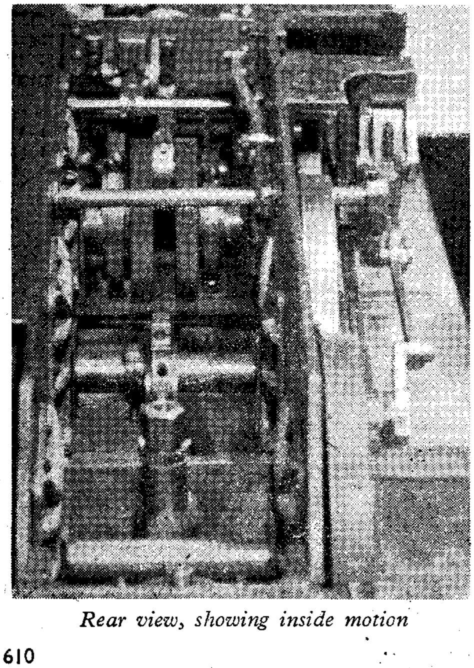
The rest of the work on the chassis was fairly plain sailing, " L.B.S.C.'s " notes being used as a guide to the methods to be adopted.

The frames and bogie being complete, the main axle-boxes were milled out and drilled, fitted to frames and reamed for ½-in. diameter axles. These were turned up and fitted, the crank axle being built up from five pieces and brazed, again by a friend in the firm.

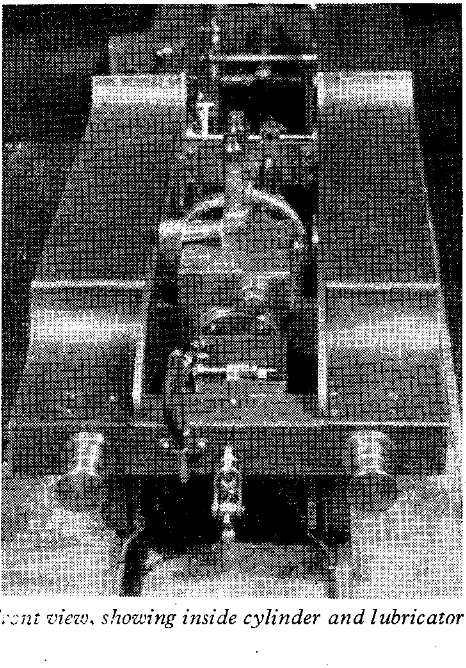
At this point, on the suggestion of another model-maker, application was made to the L.N.E.R. at Doncaster for information, as this model is similar in all respects to Thompson's rebuild of *Great Northern.* This request resulted in my receiving a ¾-front view of the engine and tender and a small-scale line drawing.

The three cylinders for the model were then taken up to the firm, where a larger lathe was available, and the bores machined, the port-faces

(*Continued on page* 613)



Rear view, showing inside motion



Front view, showing inside cylinder and lubricator

Vertical Attachment for a 3-in. Lathe

by "M.A.C."

ALTHOUGH most machining operations can, with a little ingenuity and much patience, be carried out in the centre lathe, the need often arises for additional equipment. This is especially so in cases where very small holes have to be drilled, when, owing to too low a spindle speed or lack of means for quickly and frequently withdrawing the drill, it breaks.

It was this consideration which prompted the writer to design the small attachment here described. After many small drills had been broken (most of them well inside the hole), it was decided to suspend operations on the work then in progress, and concentrate on the means of overcoming the trouble. The attachment was intended primarily for drilling, but the possibility of using it for vertical milling was kept in view and the parts made of sufficiently robust proportions to permit this.

From the general arrangement, Fig. 1, it will be seen that the sole-plate *A* is bolted to the bed of the lathe in such a position, that the vertical spindle comes above the slotted cross-slide, which then becomes the drilling or milling table.

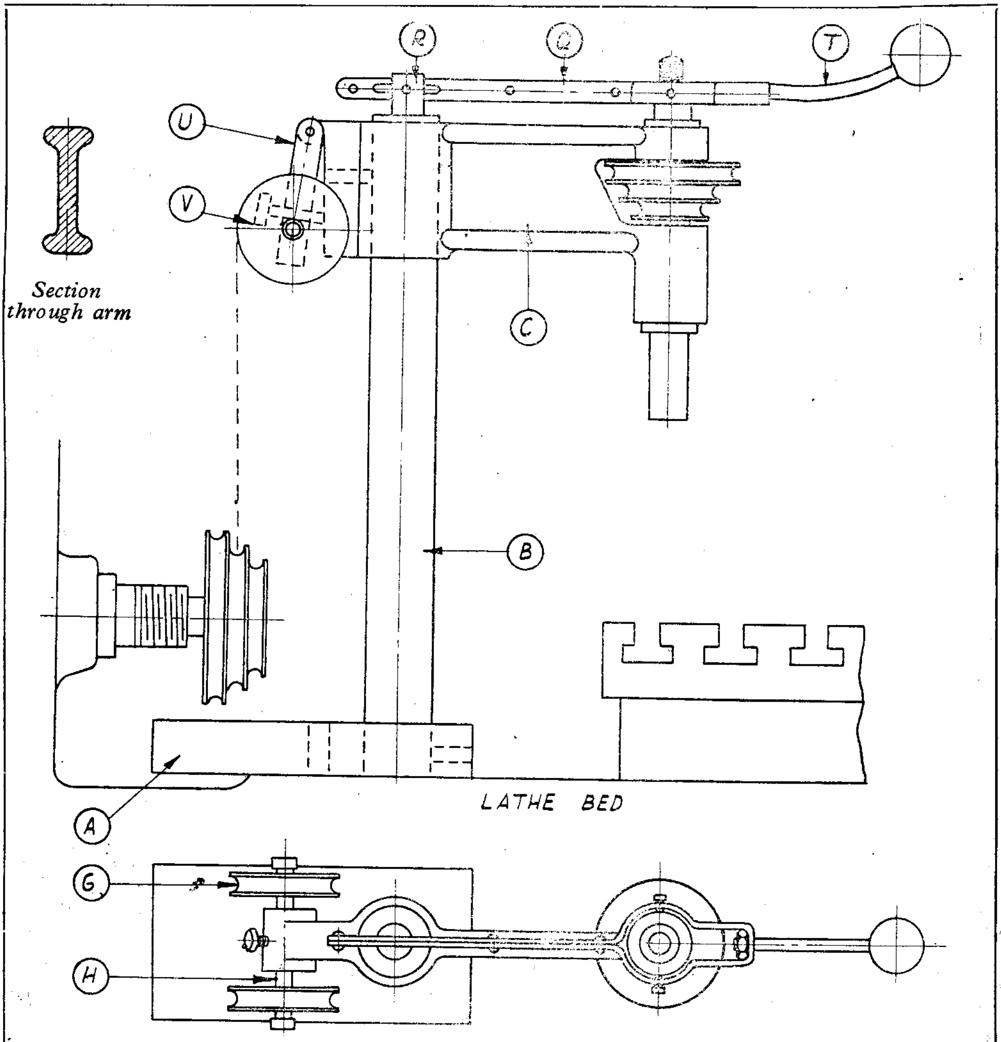


Fig. 1. General arrangement, elevation and plan of attachment

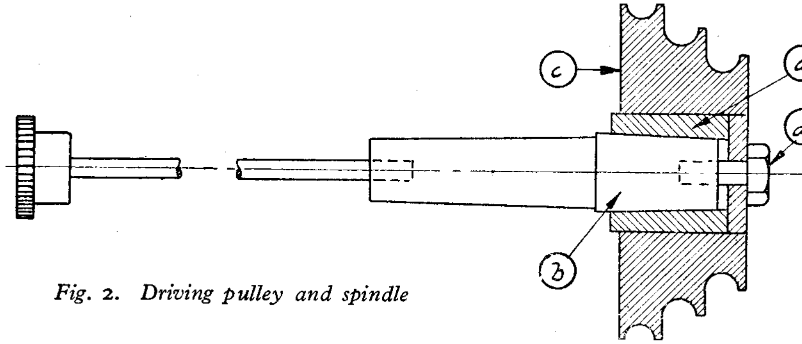


Fig. 2. Driving pulley and spindle

All the parts were machined on a 3-in. lathe and although this involved some laborious treadling, it was amply justified by the result. The accompanying drawings have not been dimensioned but are approximately to scale and some idea of the proportions can be gathered from the fact that the pillar is $1\frac{1}{8}$-in. diameter and the spindle $\frac{5}{8}$ in.

The sole-plate *A* is a piece of mild-steel, bored to receive the pillar *B*, a length of silver-steel, which is secured in place by an Allen grub-screw. The arm *C* is a duralumin casting made by an advertiser to a pattern supplied. This is of fairly heavy proportions, as shown in the sectional view. It was bored very near to finished size and the last few thousandths taken out with borrowed reamers. The bearing bushes *D* and *E* are of phosphor-bronze, bored and reamed to suit the spindle and turned with 1/1,000-in. allowance for a press-fit into the arm.

The spindle *F* was a rather tedious job, as the material used was a high-tensile gear steel of 1 in. diameter, but this was satisfactorily completed in the following manner. The bar was chucked, faced-off and centred, and turned for a short distance, then, being too large to pass through the lathe spindle, it was supported by a temporary steady.

Having ascertained the diameters at different points of a No. 1 morse-taper bore, four drills of appropriate sizes were fed in to the correct depths and the hole finally reamed with a morse reamer bought for the purpose. The 5/32-in. draw-bolt hole through the spindle proved rather difficult, but this was drilled about three-quarters of the way through with an extension drill, previously made.

The next job was to chuck and turn a brass morse-taper plug a good fit to the taper in the spindle, which was then pressed on, centred, and finish turned a tight fit to the spindle bearings which, after being pressed into place, had been again reamed. At this setting the key-way for the spindle drive was planed-out with a tool held sideways in the tool-post, the upper end screwed for the ball-race lock-rings and the 5/32-in. hole completed. The spindle was finally finished by stoning away the high spots until it would revolve freely in its bushes without any suspicion of shake.

The pulleys, which are all turned from duralumin were next taken in hand. The driving pulley was mounted on its spindle as shown in Fig. 2. A bush *a* was bored to correspond to

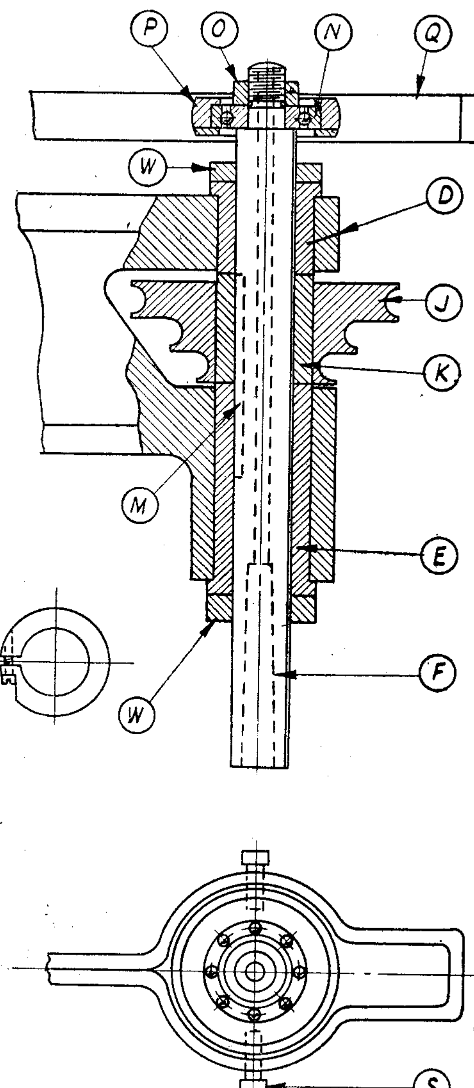


Fig. 3. Sectional elevation through spindle, and plan, showing pivot pins

the taper on the nose of the spindle *b*, and turned a good fit to the bore of the pulley *c*. It was then split, and being forced up the tapered spindle by the screw *d*, grips both it and the pulley firmly and concentrically. The larger end of *b* was tapered to suit the lathe spindle and is secured by the draw-bolt shown.

The jockey-pulleys *G*, Fig. 1, are provided with bronze bushes and run freely on the spindle *H*.

The driven pulley *J* is provided with a steel bush *K*, in which is cut a key-way to correspond with that cut in the spindle, and secured in this by two 8-B.A. screws is a key *M* of $\frac{1}{8}$-in. sq. silver-steel.

At the upper end of the spindle, a ball-race *N*, of $\frac{3}{8}$ in. bore, and $\frac{7}{8}$ in. outside diameter is secured by the lock-rings, *O*, and also pressed into a semi-spherical housing *P*. The feed-arm *Q*, was bent up from $\frac{1}{2}$ in. $\times$ $\frac{1}{8}$ in. mild-steel, and is riveted together. It pivots about a pin in the slotted member *R*, and about the housing *P*, by means of the pins *S*. The hand lever *T*, is screwed and lock-nutted to the end of *Q*, and is provided with a ball-end which was turned from a piece of black fibre, and, being nicely polished, adds greatly to the appearance.

The spindle for the jockey-pulleys *G*, is secured in the hinged member *U*, which, by means of the knurled screw *V*, provides belt tension.

The two split collars *W*, act as stops. The upper one is set to regulate the depth for drilling and milling, whilst the lower one is set to take the thrust of a milling cut against the shoulder of the lower spindle bush.

The belt is of $\frac{1}{4}$-in. diameter leather, and to eliminate the jumping and clicking usually associated with the ordinary type of fastener, the ends were cut to make a long scarf joint. These were cemented together and finally stitched with fine copper wire. This has resulted in a strong, smooth-running belt.

A very useful adjunct to an attachment of this kind is a set of setting-pieces. These are used by bringing the drill or milling cutter to the face of the work and interposing a setting-piece corresponding to the required depth, between the shoulder of the upper spindle bush and the upper collar *W*, which is then locked in position and the setting-piece withdrawn. This ensures a correct depth of cut.

In this case, the pieces were made from gauge-plate of various thicknesses from $\frac{1}{16}$ in. to $\frac{1}{2}$ in. After hardening, they were lapped flat and, when used in conjunction with a set of feeler gauges, can supply almost any intermediate depth.

The first job for which this attachment was used was to mill the vees and slots for a small compound slide-rest. The cutters were made from broken drills having No. 1 morse-shanks. The tangs were cut off and the ends tapped for the draw-bolt which passes through the spindle and pulls the cutter securely into place.

In conclusion, one further use should be mentioned, i.e. jig-boring.

With ordinary drilling methods, the production of holes whose centre distances are really accurate is usually a difficult process, but provided the spindle of the attachment is in good condition, the feed-screws of the lathe are reliable and properly indexed and the holes are carefully centred first, this becomes relatively easy. The job is mounted on the lathe cross-slide, so that all holes can be reached in one setting, and after locating the first hole the rest is simply a matter of moving the work under the spindle to the required centre distances by means of the cross and longitudinal feeds.

A $3\frac{1}{2}$-in. Gauge "Pacific"

(*Continued from page* 610)

and ends being machined on the Drummond at home, as also were the ports and passages.

The pistons were next turned up on the rods, and end covers fitted by 4-B.A. hexagon bolts to the cylinders. The cylinders were then erected in the frames, with the rest of the motion; but I found that the tail of the expansion-link, as given, differed from the calculated length, so I put both holes to check which was the correct one. The reversing weigh-shaft was made to drawing, and when erected was found to give only approximately half link-travel. This may have been due to some error on my part, but was corrected by shortening the vertical lever on the weigh-shaft to half its original length, and also raising the connection at the wheel end.

Steam brakes being decided upon, opportunity was taken to fit the cylinder, brake hangers and blocks at this point. The cheese-headed screws shown in the photographs will all be replaced with hexagon-headed bolts later.

The boiler was next made, and when the barrel and wrapper were placed in position on the chassis, the reach-rod would not line up with the wheel-and-screw; so this latter component had to be transferred to outside the frames. I do not know if any other builder of this model has found the same thing.

Bad luck found its way on to the job, at this point, as the boiler was built and tested but was found to leak very badly; it was stripped down and rebuilt, giving no better results, so it had to be stripped down again!

Attention was now given to backhead fittings, dome and smokebox, and all went off without further incident. The cab was made to sizes scaled up from the L.N.E.R. drawing. I might add that the boiler is still in course of construction. The chimney I have built up from sheet copper and silver-soldered. The tender is also partly constructed. The total time taken to carry this job so far, not counting the making of the boiler twice, is 1,334 hours.

I have to make acknowledgment to Mr. Marshall, of the firm's camera club, for the photographs.

MINIATURE INDOOR WORKSHOP

by B. Dane

THERE must be many model engineers whose style has always been cramped for lack of workshop accommodation. The present housing situation does nothing to help matters, the spare bedroom is no longer spare and huts of the garden shed variety are hard to come by. Hand tools and the kitchen table are all very well as far as they go, but cannot compete with machine tool work, and in any case, scope under built some fifteen years ago for quite a different purpose. In its original role it travelled many thousands of miles as a "trade" body on the writer's motor-cycle combination, since when it has served as general junk box and repository for those tools and bits of gear not often in use. It was only on removal to a house with little facilities for a workshop that its possibilities in this direction came to be considered.

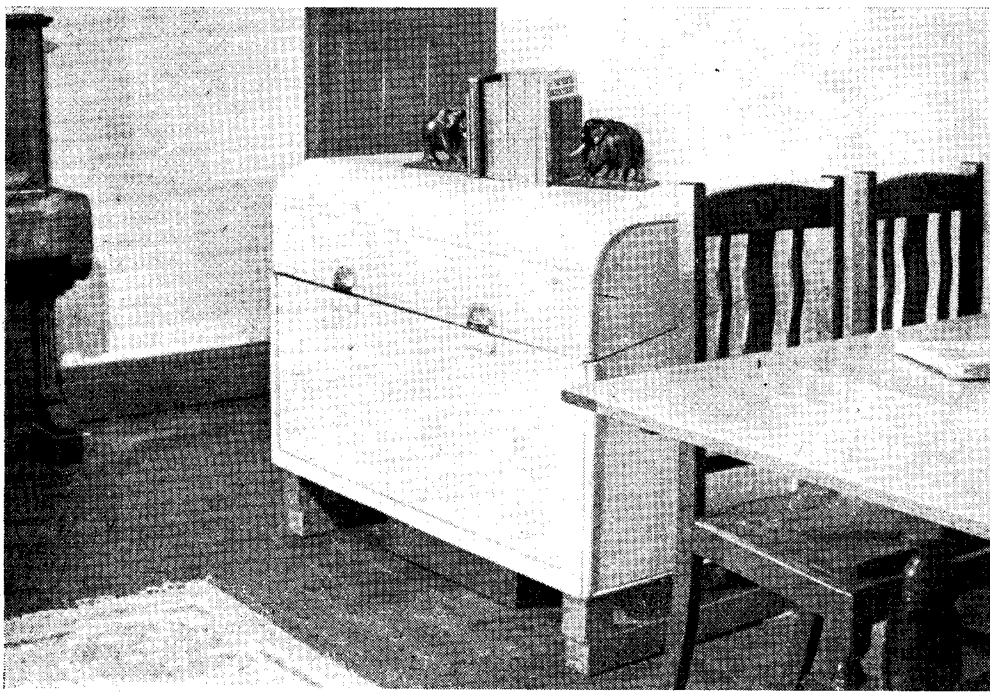


Photo by] [*A. E. Moat*

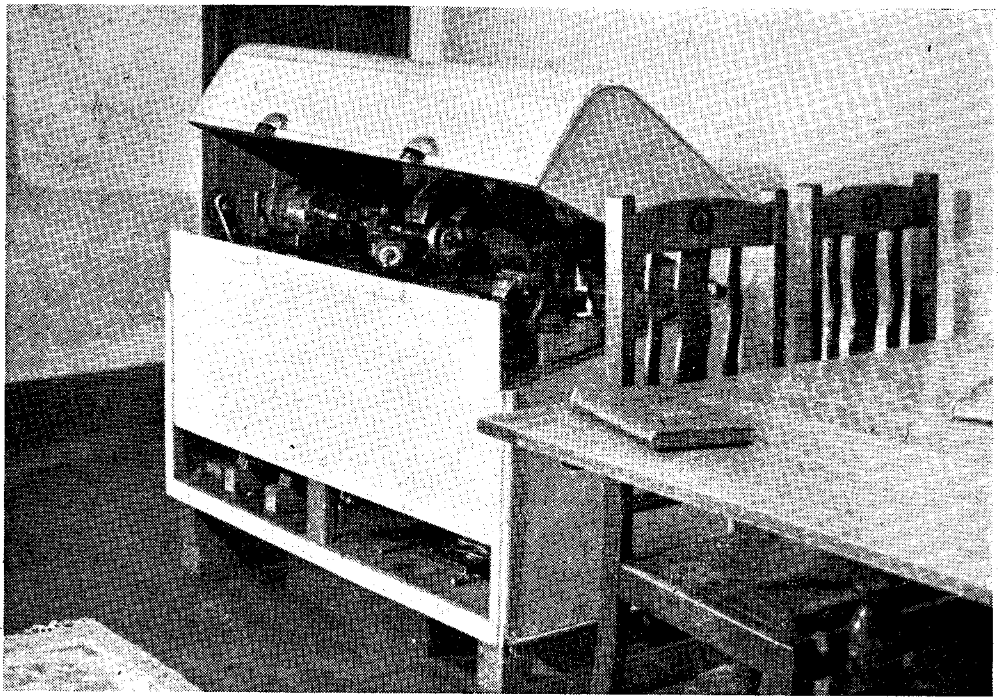
Part of the furniture

these conditions is strictly limited. And there's the problem, the backyard is no place for the 3-in. lathe any more than is the dining room table.

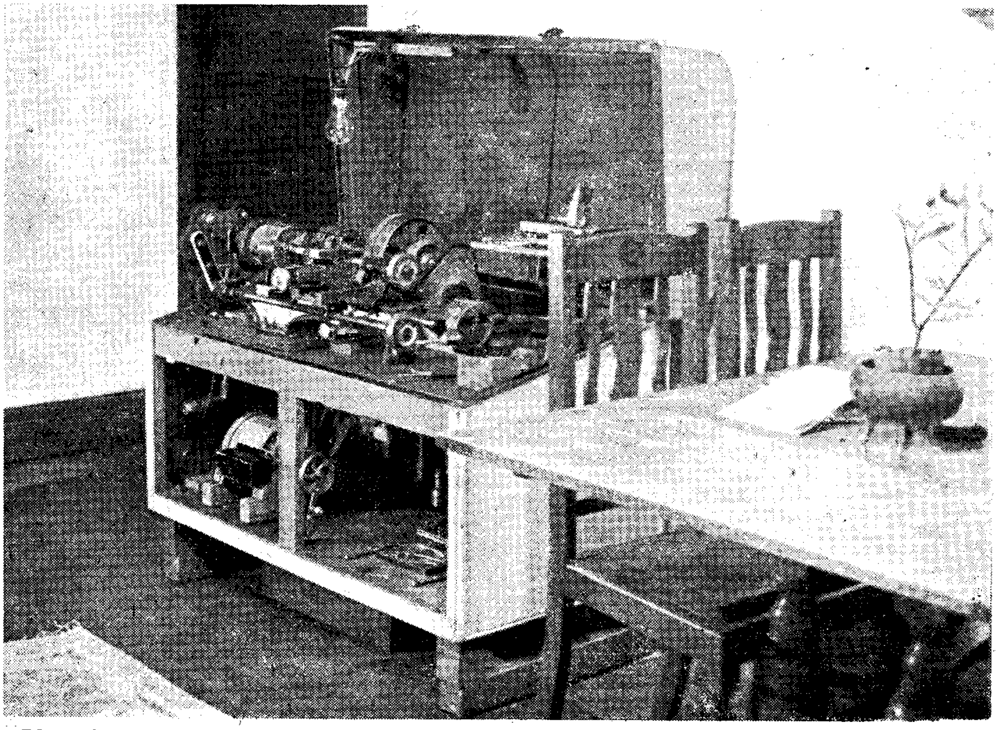
A number of solutions to this problem in the form of miniature self-contained workshops have been put forward in the past amongst which Mr. C. R. Jones' cabinet workshop, a description of which was recently published in THE MODEL ENGINEER, is an excellent example. In the light of the topicality of the subject for the reasons stated above, readers may, perhaps, be interested in the writer's own effort.

As will be seen from the photographs, the miniature machine shop is housed in a closed cabinet, about the size of a modern dining-room sideboard. The actual overall dimensions are: 3 ft. 6 in. × 2 ft. 6 in. × 2 ft. 0 in. This was

On hauling the lathe from its packing case once more, it was found that the lid of the side-car was just deep enough to accommodate the height of the lathe and countershaft. The original construction of the body was a framework of 3-in. × 1-in. deal covered with 3/32-in. ply—light, but quite strong. A bench top of 8-in. × $1\frac{1}{2}$-in. pine planks was built in flush with the internal frame and level with the front bottom edge of the lid, a gap being left between the lathe and countershaft positions to allow the motor belt to pass through. When the lathe was positioned at the left-hand end of the bench it was found that there was room for the vice to be mounted in a handy position at the opposite end. The grinding wheel is mounted on an adapted bicycle wheel hub and chain driven from



Twenty seconds only is needed to bring the miniature workshop into action



Photos by] *Ready to switch on* [*A. E. Moat*

the end of the countershaft, the sprocket hub on the countershaft being provided with a small sliding dog to engage the chain-drive when required. The shelf above carries the precision instruments clipped to it and folds up into the lid before the latter is closed.

motor is positioned on the bench top under the lead screw dog clutch.

To bring the bench top up to height, the wooden stand was fitted below the cabinet, and this allows the operator to sit quite comfortably at the machine, knee-hole desk fashion. This, of course, is entirely a matter of personal taste, the stand height could easily be varied to suit those who prefer to stand. To complete the job, racks for tools were fitted in the lower part and a folding bracket to carry a light bulb fitted into the lid. Outside, a coat of cream enamel, plated drawer pulls, and corner beading finishes the cabinet off as a part of the furniture.

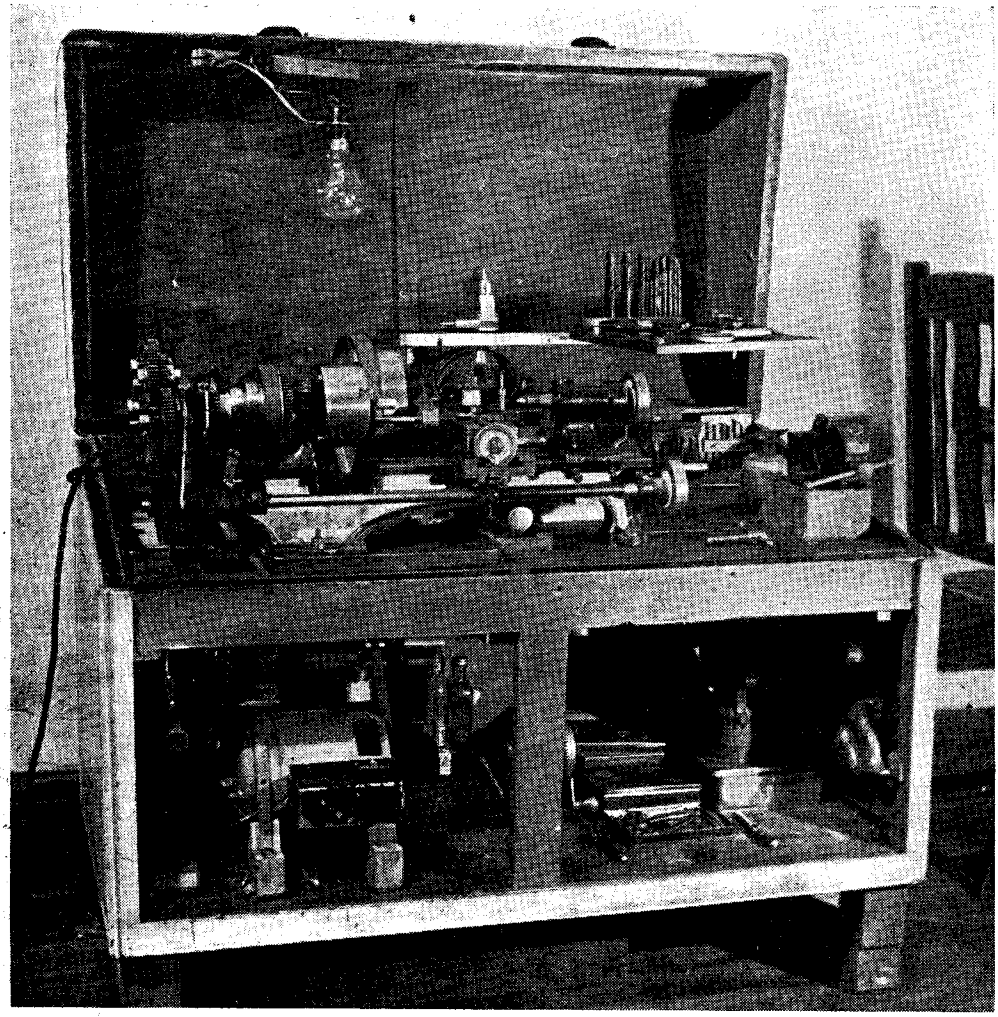


Photo by] *Close-up, showing position of motor drive* [*A. E. Moat*

With the bench fitted at the top, access to the lower part of the cabinet had to be arranged. Accordingly, the thin ply front was cut out and replaced by a sheet of sturdier material, $\frac{5}{16}$ in. thick, which was arranged to slide up and clear when the workshop was in action. The motor was mounted on bearers on the lower floor with the belt running up through the bench to the countershaft fast and loose pulleys, the shift being operated by the plated knob seen just below the lead screw of the lathe. The switch for the

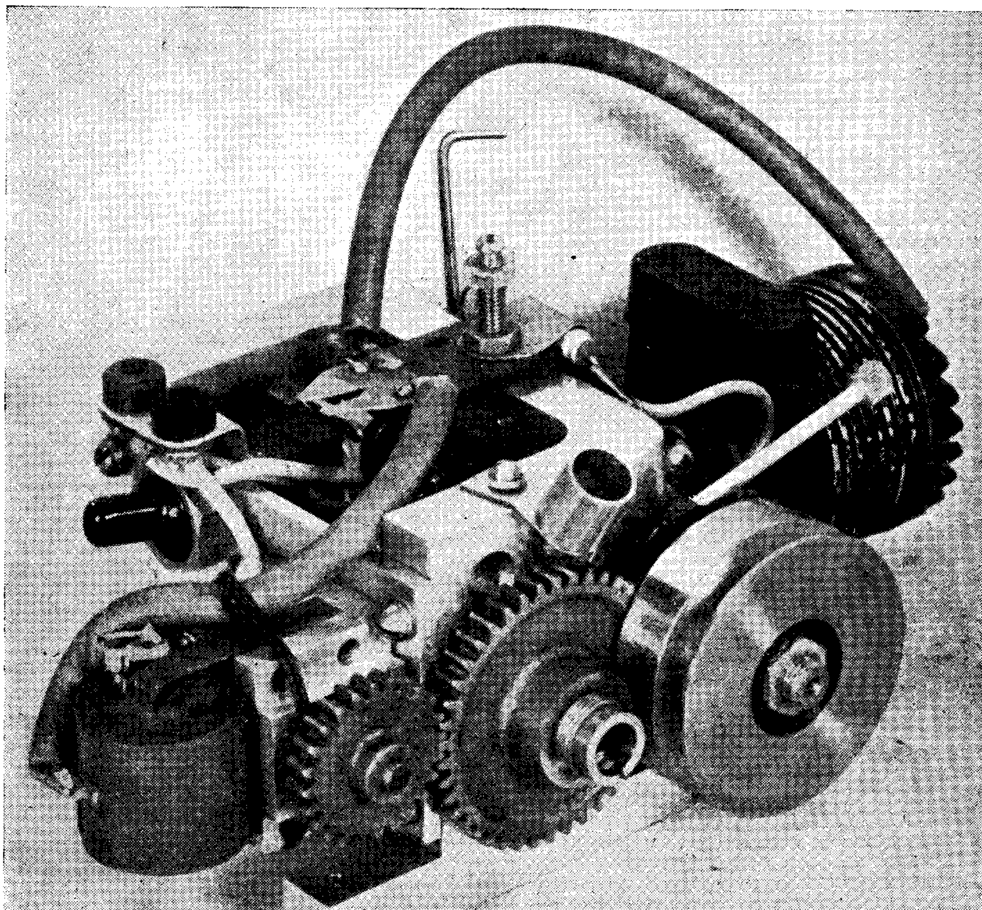
To bring the little workshop into operation all that is required is to lift the lid, slide out the front and plug in the power lead.

PETROL ENGINE TOPICS

Auxiliary Drive Problems

by Edgar T. Westbury

MANY users of the simpler types of petrol engines find some difficulty when adapting these to purposes which were not envisaged in their original design. In the majority of these engines, the only shaft extension provided is that at the front of the engine on which the propeller hub, or flywheel, is usually fitted. While this is sufficient for the requirements of many power installations in which these engines are used, occasions often arise when it is necessary to provide a drive for some auxiliary piece of equipment, such as a water or oil pump, and within the last year or two, the introduction of the miniature magneto has presented yet another problem in this respect. Several readers have written to me recently for advice on the fitting of magnetos to small engines installed in model boats and cars, and although there are few engine installations in which this cannot be arranged with a little ingenuity, the success of the entire power plant may depend on how well the practical details of the scheme are carried out.



Spur-geared magneto, as employed on Mr. L. S. Pinder's 10-c.c. racing car

In model boats, where the drive to the propeller is generally taken by means of a positively-coupled shaft, it is often possible to introduce the magneto in the transmission line. The modern

type of rotary-magnet magneto is particularly applicable to installation in this way, as it is possible to provide a solid shaft running completely through the magneto, and capable of being fitted with couplings at each end. There is very little liability of the magneto becoming damaged by any reasonable torque applied to its shaft, as might be the case with a rotary-armature magneto.

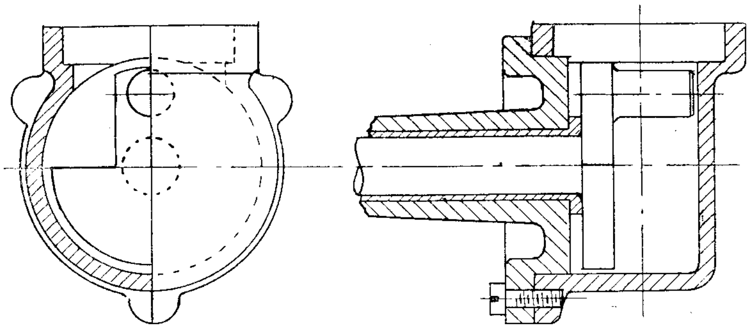


Fig. 1. Form of crankcase commonly employed on simple engines with overhung cranks.

I know of several model boat engines of 5 c.c. or even less, in which the magneto has been installed in this way with complete success. A similar method of installation may sometimes be employed in the case of model cars of the type in which a transmission shaft is taken from the engine to the final drive gear box in the orthodox way, but a snag is liable to arise in the case of cars fitted with a centrifugal clutch. If the clutch is fitted directly on, or in close proximity to, the engine flywheel, which is certainly the best place to put it, the drive to the transmission shaft will, of course, not be positive, and therefore the magneto could not be kept in correct timing if fitted anywhere in the transmission line. The alternative of fitting the centrifugal clutch at the gear-

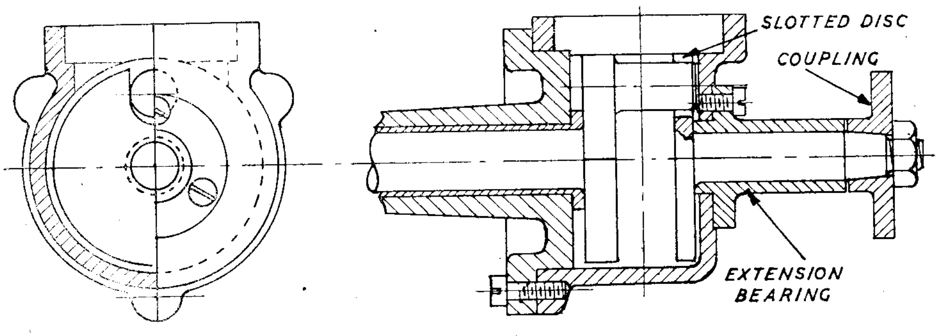


Fig. 2. Extension bearing fitted to take auxiliary or "follower" shaft

box end of the transmission line is practicable, but may tend to be somewhat more cumbersome, and it also deprives the engine of a certain amount of flywheel momentum, which is normally to be obtained from the mass of the rotating clutch members attached to it.

In driving auxiliaries other than those which have to be timed in exact relationship to the engine, the above does not necessarily apply, and in many cases, non-positive drives have proved quite satisfactory for such accessories as lubricating and water circulating pumps, which are often driven by means of a belt or friction wheel from the engine flywheel. Some examples have been encountered of magnetos driven by gearing from the engine, but personally, I am rather against the use of gearing, especially on very small engines, because it is liable to introduce fairly considerable mechanical losses, especially when run at high speed, and when the gears themselves, or their method of mounting, lubrication, etc., are not ideal. There have, nevertheless, been one or two very successful examples of gear-driven magnetos employed on model racing cars, and the method of drive may simplify installation in cases where the main drive from the engine to the track wheels incorporates spur gearing.

Simple engines with a single power take-off may often be adapted without great difficulty to take an auxiliary drive through the "blank" end of the crankshaft. Many commercial engines have a crankcase somewhat similar to that illustrated in Fig. 1, in which the main crankshaft bearing is carried in a detachable housing at the front of the crankcase, the rear side having no provision whatever for the fitting of a bearing housing. It is, however, often possible to fit an extension bearing in the manner illustrated in Fig. 2, the most convenient arrangement in the example illustrated being a flanged gunmetal bush attached by screws or rivets to the rear side of the crankcase, after boring and facing a suitable seating on the latter. The auxiliary drive shaft

in the form of a "follower" with a large diameter flange, slotted out so as to fit fairly closely on the overhanging end of the crankpin. Most of these engines have a little spare length on the end of the pin, over and above that occupied by the width of the big-end bearing, but if not, it is often possible to reduce the width of the bearing just sufficiently to allow the disc to engage the shaft, $\frac{1}{16}$ in. being quite ample to drive the disc, so long as the latter is carefully fitted and cannot move endwise out of engagement. With this form of drive, perfect alignment of the extension shaft with the main shaft is not absolutely essential, though it will be desirable to maintain this as closely as possible. For boring and facing the seating for the extension bearing, the crankcase should be mounted on a turned spigot held in the lathe chuck and provided with a square shoulder, against which the joint face of the crankcase can be firmly abutted. If necessary, clamps may be arranged to engage over the screw bosses on the crankcase, to pull the latter firmly against the machined face of the chucking spigot.

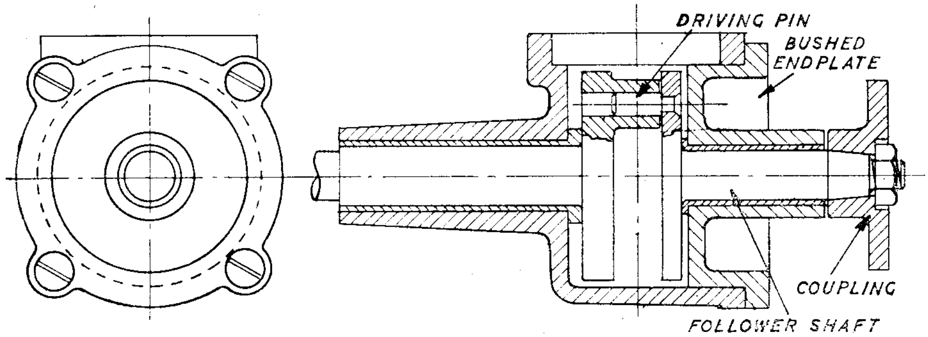


Fig. 3. Special rear endplate fitted to take follower shaft

Securing the Shaft

A small magneto absorbs very little power, and so far as actual torque transmitted by the auxiliary shaft is concerned, this could be carried quite easily by a shaft no larger than $\frac{3}{16}$ in. diameter, but one of the difficulties which is likely to arise when such a small shaft is fitted, is the provision of a really sound method of securing the coupling or driving flange at the outer end. It will readily be apparent that the keying or other positive fixing of the flange on a very small shaft will call for rather delicate fitting, and the common expedient of a sunk grub-screw, or a small cross pin, fitted through the boss of the coupling and the shaft may not be found highly satisfactory. Grub-screws have a habit of falling out at the most awkward times, and very small pins are easily sheared. A much more satisfactory method of fitting a coupling is by means of a cone and nut, as in the example illustrated in Fig. 2, but this form of fitting demands a fair amount of friction surface to hold really well, and I recommend that a shaft not less than $\frac{1}{4}$ in. diameter should be used. This will allow of using a taper of from 5 to 10 deg., and leave sufficient diameter at the end of the shaft for a $\frac{3}{16}$ in. or 2-B.A. nut, which will provide ample security. It is recommended, wherever possible, that the driving disc should be integral with the auxiliary shaft, or at least that its method of attachment thereto should be quite beyond suspicion. A brazed or silver-soldered joint is quite satisfactory if properly carried out, but the small amount of room available in the crankcase of a small engine will usually make it impossible to use a built-up arrangement of shaft and disc involving the use of screws or nuts.

In the case of engines which have the main bearing housing integral with the crankcase, and a detachable endplate at the rear of the crankcase, it is generally most satisfactory to make a completely new endplate, with a bushed extension to take the auxiliary shaft, as in Fig. 3. Engines which have a fuel reservoir incorporated in the rear endplate, as in the Kestrel 5-c.c. engine, may call for some modification in the position of the reservoir, but if this is objected to, it is quite practicable to run a bush concentrically through the centre of the reservoir, provided that this is fitted in such a way that no fuel leakage around the bush is possible. The Kestrel engine, and several other engines of my design, are equipped with hollow crankpins, and this enables the drive to the disc to be taken by a pin instead of a slot. Although, in engines of the size under consideration, it is not possible to use a driving pin of larger diameter than $\frac{1}{8}$ in., this will be quite adequate, providing that the pin is fitted to the disc really securely. It is also, of course, essential that the pin should be set at the correct radius to engage the crankpin without binding when the auxiliary shaft is assembled. I have had two or three engines working quite satisfactorily with this form of drive; in one case, the arrangement has worked for nearly seven years without the least trouble having developed. Engines which do not conform to the principles of design illustrated may present their own particular problems, but it is usually possible to overcome them by using somewhat similar measures. Some of my engines have detachable housings or endplates at both ends of the crankcase, and these are probably the easiest of all to adapt, as the desirability of some modification was contemplated in their original design. It will also be fairly apparent that the follower crank arrangement can be incorporated quite easily with a rotary admission valve. Although, in most of

my engines which are fitted with valves of this type, the valve disc is allowed to float on a stationary pin, it is quite practicable to key the disc to a live shaft, and extend this through a suitable bearing for use as an auxiliary driving shaft. Rigid mounting of the disc on the valve has been applied in several cases, and works fairly satisfactorily, but there are some advantages in making the valve an easy fit on the shaft, and keying it positively to transmit rotation by means of a key or peg engaging a key-way in the valve disc. This arrangement has frequently been used for driving a rear contact-breaker, but the form of coupling employed with an auxiliary drive shaft of this, or indeed any other type, may be varied to suit the convenience or preference of the constructor.

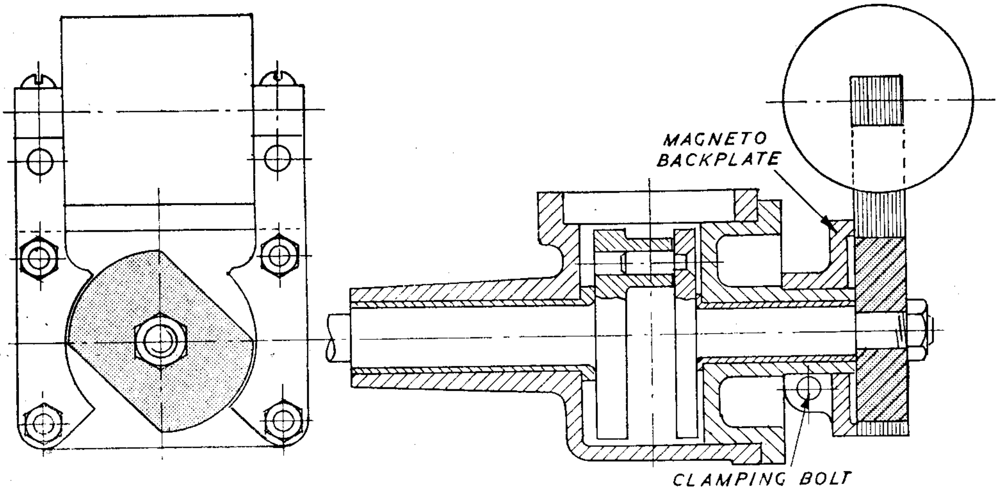


Fig. 4. Magneto backplate fitted directly to extension bearing

In cases where an auxiliary drive is required on engines having a rotary admission valve, it frequently happens that the position of the carburettor makes it extremely difficult to fit a magneto coupling in close proximity to the carburettor. Sometimes this difficulty can be overcome by extending the shaft to a sufficient distance to clear the carburettor, but in many cases this occupies too much room to be really convenient, and it may be better to arrange the carburettor with a right-angled bend in the induction passage, or at some intermediate angle so that it projects well clear of the shaft line. An example of an engine in which the possibility of adding an auxiliary drive has been visualised is the "Ensign" 10-c.c. engine, in which the carburettor projects at an angle of 45 deg. (See cover picture.)

The auxiliary shafts shown in the drawings have flanged couplings which may be arranged to engage with their counterparts by holes or pins, possibly with the interposition of fibre or hard rubber blocks to promote silence and increase flexibility. It is quite possible to introduce a vernier timing device in couplings of this nature, and it is hardly necessary to go into exact details of such devices, as they are fairly well known to all who have had experience in automobile engineering. Simple couplings of the "dog" or "ball and pin" type may also be used if desired, and will prove quite satisfactory if carefully made and fitted. Case-hardening of the engaging components is desirable to improve their working qualities, and the same also applies to the slotted disc or pin drive of the auxiliary shaft itself.

The arrangements so far illustrated refer mainly to the use of entirely separate magnetos, or other power-driven auxiliaries, but it will be fairly obvious that space and weight may often be saved by making such auxiliaries an integral part of the engine, so that they require neither couplings nor additional shafts or bearings. Fig. 4 shows an example of a magneto fitted directly to the extension boss of the endplate so that the rotor of the magneto can be fitted directly to the auxiliary drive shaft.

The method of mounting the magneto is to provide it with a backplate bored to fit closely on a concentric seating and the extension boss, and provided with a split clamp to secure it in position. This particular form of fitting enables the entire magneto to be partially rotated around the bearing, in such a way that the timing of the magnet relative to the stator poles can be varied, so as to produce the most efficient spark possible at any spark timing position. It is assumed that in cases where the magneto is attached directly to the engine, the original contact-breaker fitted for coil ignition will be available, and this can be utilised to serve the magneto equally effectively. For the purposes of obtaining the utmost spark efficiency at all settings of the contact-breaker, it would be desirable to interconnect or otherwise synchronise the magneto mounting with the contact-breaker, but in actual practice this is rarely necessary, and the main advantage of being able to rock the magneto itself is simply to find out the optimum sparking position in the first place, after which, further adjustment of the magneto is generally unnecessary.

In some cases, it may be more convenient to

bolt the magneto rigidly against the flange of the rear endplate, and this may enable the space occupied by the magneto to be still further reduced and the extension shaft shortened. This, however, may be a dubious advantage, as it may bring the coil of the magneto too close to the engine cylinder, so as to be liable to damage by heat, and the bearing may become too short for steady running and durability. The magneto demands a well-fitting bearing, because of the desirability of keeping the clearance between the rotor and stator as fine as possible. There is some advantage in using one or more ball-races on the magneto drive shaft for this purpose, as these may reasonably be expected to hold the clearance constant over a very long period without being affected by wear. The use of ball-races, however, introduces another complication in the case of two-stroke engines, as they do not seal the shaft against pressure leakage like a well-fitted plain bush, and some other provision, such as a seal ring or labyrinth packing, may become necessary. In any case, it should be carefully borne in mind that the fitting of an auxiliary shaft to a two-stroke engine introduces a potential source of pressure leakage from the crankcase, over and above that already involved by the main bearing itself, and it will be fairly clear that the fitting of the auxiliary shaft in its bearing must be as carefully carried out as that of the main shaft.

THE MODEL ENGINEER EXHIBITION

Schedule of Competitions and Prizes

ENGINEERING MODELS

SECTION A. Club Team Championship

This section is open to recognised clubs and societies for the best representation in the Competition Section by the individual entries of their regular members. Clubs and societies should nominate three entries of any type or class for consideration.

SECTION B. Locomotives and Railways

Class

1. Steam Locomotives over "O" Gauge.
2. Locomotive Models—"O" Gauge and under, and Model Railway Rolling Stock and Accessories.
3. Locomotives—Internal Combustion and Electric Types.

SECTION C. Marine Models

4. Steam and Motor Ships of any period.
5. Working Model Steamers.
6. Sailing Ships of any period.
7. Working Model Yachts and Sailing Ships.
8. Hydroplanes and Speedboats.
9. Miniatures—1/32-in. scale and under.

SECTION D. General Models

10. General Engineering Models (including Marine Engines).
11. Internal Combustion Engines.
12. Mechanically Propelled Road Vehicles (including Tractors).
13. Model Racing Cars (self propelled).
14. Tools and Workshop Appliances.
15. Scenic and Representational Models.
16. Horological, Scientific and Optical Apparatus—and work not otherwise classified.

SECTION E. Juniors

17. For any type of model or mechanical work by a junior under the age of 17 by August 18th, 1948.

AIRCRAFT MODELS

(Organised by the Society of Model Aeronautical Engineers)

SECTION F. Club Team Championship

This section is open to recognised Clubs and Societies for the best representation in the Competition Section by the individual entries of their regular members. Clubs and Societies should nominate three entries of any type or class for consideration.

SECTION G. Seniors

18. Wakefield Type Models.
19. Power-driven Models.
20. Sailplanes.
21. Rubber-driven Models.
22. Solid Type Models (to any scale).
23. Original Flying Exhibits.

SECTION H. Juniors

24. Rubber-driven Models.
25. Power-driven Models.
26. Sailplanes.
27. Solid Type Models (to any scale).

PRIZES AND AWARDS

Club Team Cup. A special cup is offered to recognised Clubs and Societies for the best team of three exhibits entered.

Championship Cups are offered for the best Locomotive, Steam or Motor Ship, Sailing Ship, General Engineering Model in Section B, C and D, and for the best Aircraft Model in Sections G and H.

A Junior Championship Trophy is offered for the best model aircraft on exhibition in all competition classes, made by a junior.

Silver and Bronze Medals are offered in all classes from 1 to 16, and 18 to 27, provided the work is considered by the Judges to be of medal standard. The medals will be awarded on the quality of individual models and not on any placing of the entries in order of merit in a class.

Diplomas. The Judges will be empowered to award diplomas in recognition of special merit in all classes at their discretion.

Money Merit Prizes will be awarded at the discretion of the Judges in all classes from 1 to 16. In Class 17 prizes to the value of £2, £1 and 10s., as First, Second and Third prizes respectively are offered.

SPECIAL AWARDS

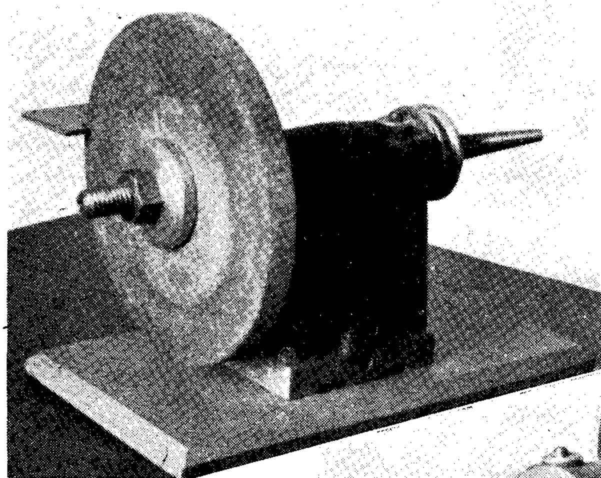
The Wellingham Cup is offered by Col. H. J. Wellingham for the best exhibit in Class 11.

The Bristol Challenge Cup will be awarded for the best aircraft model of a Bristol machine (any type) entered in the competition.

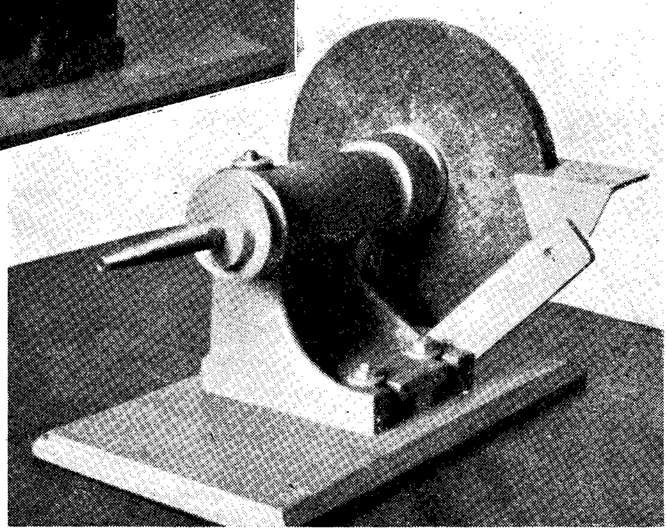
(Any additions to the Prize List will be announced in THE MODEL ENGINEER or *Model Aircraft.*)

A Simple Grinding Head

by H. Stonehouse



Left—Rear side view of grinding head



Right—View from front, showing tool rest and support

THIS grinding head can be made in about four or five hours, and requires only elementary engineering skill. Semi-scrap material can be used, and although not of the best design, it serves its purpose very well.

The main support is an old tailstock of a lathe, from which all fittings have been removed. The original bearing is already prepared for the spindle, and the hole where the tightening handle is normally fitted acts as an excellent oil reservoir. The shaft is made from $\frac{3}{4}$ in. mild-steel rod, which is turned between centres, using a three-point steady to prevent springing. There is a Whitworth thread cut on one end of the shaft, while the other end is turned down to a tapered left-hand thread.

The wheel cheeks and the pulley are machined from a duralumin block and are tightened up by the nut. These cheeks should be fairly stout, so as to get a firm grip on the wheel. Between them and the wheel there should be a cardboard packing-piece to take up any unevenness in the surfaces.

The taper thread can take either a polishing mop or buffing tool, whichever is needed.

The tool rest is made from a piece of 1 in. $\times$ $\frac{1}{4}$ in. mild-steel and a piece of angle iron from an old bedstead. A slot can be filed out of this plate to allow the support to be on the sides of the wheel as well as in front.

To drive this grinding head a $\frac{1}{4}$ h.p. motor is required, to give a stone speed of approximately 3,000 r.p.m., to suit a 6 in. diameter wheel of medium coarse grade.

Editor's Correspondence

"Treadling"

DEAR SIR,—The reason for the particular treadle motion shown in Mr. K. N. Harris's sketch, is not, as he suggests, one of hoped-for perpetual motion, but simply to reduce the arc of the foot travel—less "knees up Mrs. Brown"—which, if more than four or five inches above that of the standing foot, can be very tiring—the reason for much of the dislike prevalent for this mode of power.

I won't waste valuable space reproducing our friend's admirable sketch, but if he and other readers will just refer back I will try to explain. His crank throw is 2½ in., therefore, the stroke is 5 in. That stroke, transferred to the top end of vertical member *via* connecting-rod, swings the former through an arc of 5 in. The actual treadle, being of same length as shown, therefore, *also* moves through a similar arc of 5 in. and our knee therefore again, must rise and fall a like distance. Got it? Now then, taking the suggested more orthodox position for the connecting rod, which, in this case, is located nearer the fulcrum point than it is to the tread-board, that point of connecting-rod location must rise and fall a distance equal to crank stroke of 5 in. Therefore, the actual foot-board will rise and fall through an arc considerably more than 10 in. or double the stroke of crank—according to Mr. Harris's sketch it will come nearer 15 in., which is a treadle stroke which would put *me* off, and I have been treadling lathes on and off since I was tall enough to do so—somewhere round forty years.

Even if connecting-rod was located midway on treadle bar, 10 in. would be too high. The ideal is from 3½ in. to 5 in., which moderation can be obtained by using short crank throw and heavy flywheel/wheels, with plenty of weight in the rims. By locating the connecting-rod closer to fulcrum point, one certainly gets more power (leverage), but the higher must then the foot and knee be raised. These old-time lathe workers knew quite a bit about such things, as they had to treadle to live, in a lot of cases. I began my lathe career at a time when treadling was being decried as too reminiscent of treadmill labour, but none the less had enough practice to learn how to stand freely on one leg and use hand-tools, chasers and so on; besides which we had to smooth-file and hack-saw in the lathe, both these operations becoming automatically synchronous with our foot action—as also did the ruminatory action of "bacca-chewing," an art we cultivated in the hope, I believe, that it would prevent our swallowing an undue amount of brass dust resulting from the emery-clothing of brass tube off-cuts in the lathe. Anyhow, I was (at the tender [?] age of sixteen or so) vastly intrigued with the cud-chewing action of one of my elderly mates—nice old Scot, name of Murray—and after much perseverance (and sickness) at last mastered the art of chewing, thus becoming a turner or more properly, perhaps, a "torner." Those happy days are a long way back now, though not so long ago that I cannot recall all of it.

Without digressing too far from the original point of this letter, possibly a little explanation of one other may not be out of place. My reference to filing in the lathe may be the cause, possibly, of raised eyebrows—a good turner don't need to file, eh? A turner has as much right to smooth-file a job as a grinder has to grind a job that has come off a lathe, and, from some "ground" jobs I've seen, I'd certainly do a better job with a smooth file or turn 'em "dead," given the time. Grinding saves time; so does filing; and anyway, if filing is taboo, why make pivot files and filing rests for watch, clock and instrument makers?

Reverting a moment before finally closing, may I add that a board placed in front of treadle is an advantage and ease to knee action, if this is made same thickness as distance treadle is above floor when at rest, the standing leg then being exactly level with other.

In these progressive days of electricity shedding slowdowns on motor revolutions, and complete cut-offs, it's quite an advantage to be able to treadle easily; may get one out of a jam often enough.

My old 5-in. Milnes treadles like silk and can keep it up indefinitely once it's swung over. It's on silent chains each end.

Yours faithfully,

Penzance. HERBERT J. DYER.

[The above letter is typical of a number we have received on this subject.—ED., "M.E."]

Removing Mandrel on Old-Type Drummond Lathe

DEAR SIR,—In view of the letter and sketch sent in by Mr. Jaques I should like to comment further on this matter.

If the sketch is even approximately correct, Mr. Jaques' lathe is very different from mine. In the first place, if the coned bushes are opposed as shown, there would be no need whatever for a slot cut through the bush. By releasing the adjusting ring, the whole bush would withdraw with the mandrel, and I find it difficult to believe that Drummond's ever turned out the lathe as it now apparently is.

In my lathe there is no such slot through the bush and the front bearing is much larger than the back one.

As previously stated, I have never dismantled my headstock, but it seems obvious to me that the front bearing is large in diameter, the mandrel being reduced from this point and the key for the large gear-wheel will not stand proud of the bearing surface; hence the mandrel will pass through the bearing without difficulty. The cones on my lathe both draw forward when closing. The bushes have six saw-cuts, three from the front and three from the rear, but none of them, of course, extend the full length of the bearing.

I do not think there can be any doubt that the mandrel will pass out, as otherwise it would have been impossible to assemble the headstock in the first instance.

Yours faithfully,

Bury. HARRY N. OPENSHAW.